

PC MAGAZINE

The PC's Expanding Palette

44 Desktop Publishing, Image-Editing, and Illustration Tools for Pro-Style Graphics

NETWORK EDITION

Small-Office Nets

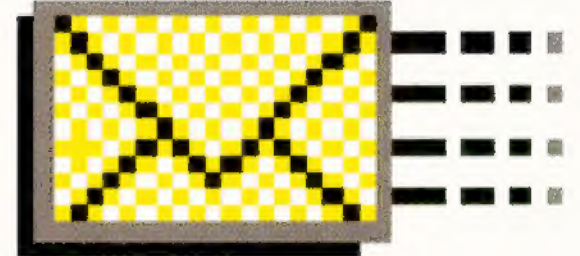
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Home Connectivity



***The
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**PC Labs Tests
7 Powerful
Graphical
Workstations**



Microsoft Office 97/now/

Subject

Received

FW: Home Essentials

Fri 3/7/97

RE: Hey there!

Hey guys: I realize you're all looking forward to doing a major presentation at 8:00 A.M., but as it happens, the meeting time has been pushed back to 3:00. So sleep in an extra 17





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CIRCLE 157 ON READER SERVICE CARD

Total Value of Ownership



A couple of weeks ago, the server on which we work on upcoming issues of *PC Magazine* crashed. Everywhere at the magazine folks were moaning and groaning about how they couldn't access the copy they needed to edit, even though they were on deadline. Many ended up working late to get the magazine completed on time.

Even though the problem was fixed quickly, it brought home all the discussions about total cost of ownership. After all, there we were, many enthusiastic editors unable to do our jobs because of a network malfunction.

Advocates of total cost of ownership (TCO) analysis—and particularly backers of the Network Computer idea—rightly point these out as drawbacks of personal computers. PCs cost the average organization a lot more than the initial purchase cost. There's also training, support, maintenance, and upgrading, as well as the downtime we recently experienced.

All of this is significant—and we wouldn't be doing our jobs if we didn't occasionally ask whether the expense is justified. I have no doubt that using new technology has been a good thing for us. But how do you measure this benefit? There's the rub.

Here's a brief synopsis of computing at *PC Magazine*: We have three full-time employees who support the computers and software we use for writing, designing, managing, and producing the magazine. Like most magazines, we've been using desktop publishing for years, as it lets us produce a highly designed magazine much faster than manual techniques. Over the past few years, we've utilized technology to allow for creative flexibility and reduce our lead times considerably.

For example, a while back, we started transmitting pages electronically to our printer. A couple of months ago, we switched to a high-end digital camera for most of our photography.

Economists have been arguing for years whether computer technology has a positive or negative effect on productivity. In most formulas, it doesn't show up well, in part because we still tend to measure productivity on industrial-age standards of physical goods produced. No

one has figured out how to gauge the output of information-age companies.

One way we could evaluate the benefit of technology is to look at revenue per employee, which is rising in many organizations. Not all of this is due to computer technology: It also reflects new technology in other areas (such as materials), the increasing globalization of many markets, and

new management techniques and structures.

Measuring revenue per employee with and without technology might be one way to weigh the value of technology. Still, that doesn't help many organizations that have missions that wouldn't exist without it.

Would a setup with thin clients and fat servers—as some have suggested—improve productivity? My guess is that it would depend on the kinds of applications more than anything else. In a situation where a lot of employees are working with the same application—such as order entry—it may very well succeed. In other situations, where you need multiple apps, individual data, or a significant number of large local files, PCs may turn out to be more cost-efficient.

For instance, even when our server was down, a lot of people were still able to do useful work—writing and editing stories for issues that weren't yet in our publishing system—because they had the data and programs on their local machines. Sure, you can argue that we should have had redundant hard disks and backups (we did), or even redundant, fault-tolerant machines (we didn't). But that would have raised our server and maintenance costs. Would it have been more cost-effective? It's hard to tell without doing the math.

What would really help all of us who manage technology is an easy methodology for measuring both the expected costs and the expected benefits of adopting technology. That way we could measure the total value of ownership. After all, that's the true bottom line.


MICHAEL J. MILLER

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BY DAVID LINTHICUM The graphical workstation market is reaching fever pitch as new Pentium Pro machines challenge the RISC/Unix systems that currently dominate this space. Does the x86 architecture stack up? PC Magazine Labs tests seven systems—from PCs to Macs to Unix machines—running engineering, CAD, and 3-D applications.....101

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What's New Online

Speed demons
See for yourself just how fast the fastest desktop

systems ever really are. By using our Interactive Benchmark Test Viewers, you'll be able to slice and dice the performance results to analyze the relative merits of these seven intriguing systems.

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THE PC PALETTE

Graphics Software

BY LUISA SIMONE The PC is coming into its own as a platform for professional graphics, as demonstrated by the range of powerful programs for desktop publishing, image editing, and illustration we tested for this professional graphics roundup. In addition to producing documents and graphics for print, these products are being called on to create graphics designed specifically for the Web. The best of these packages have added new features or even entirely new toolkits to help designers excel in this new medium.....141

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Desktop Publishing

BY LUISA SIMONE The product names may sound familiar, but these four desktop publishing programs offer a host of new features, including some innovative tools for building Web content. Features such as the ability to reformat documents for the Web on the fly, or to convert table-of-contents and index entries into hyperlinks

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Illustration

BY LINDA AND ERICK VON SCHWEBER Illustration programs are gaining greater attention as artists turn to them to create vector-based graphics. With their scalability and small file sizes, vector graphics are ideal for putting logos and technical illustrations on the Web. These seven packages give you greater control over illustrations

GRAPHICS SOFTWARE

Image Editing

BY SALLY WIENER GROTTA AND DANIEL GROTTA

Thanks to ever-more-powerful hardware, sophisticated image editing is now within reach of just about everyone. As we discovered, image-editing software is poised to take advantage of all that processing power. These seven programs let you transform photo-realistic bitmapped images into works of art for print or Web output161

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SIX KEY REASONS TO MAKE YOUR PAPER FORMS ELECTRONIC.

1

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2

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3

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4

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5

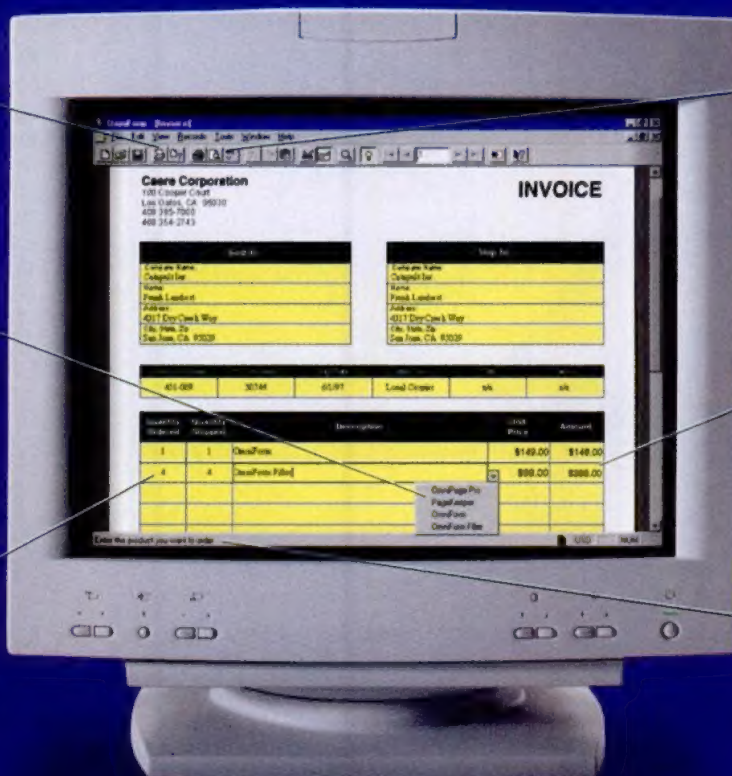
BUILT-IN CALCULATIONS:

Electronic forms can create calculations automatically or just drag and drop using over 35 Excel-like calculations.

6

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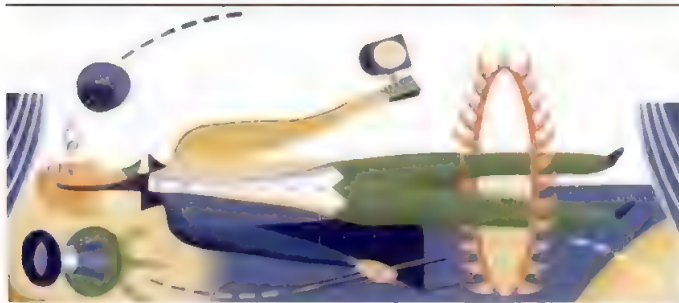


Available for Windows 95, Windows 3.1, Windows NT and Macintosh

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Pipeline



The Web, via Thin Air

Getting a single stock quote from the Web over a wireless connection can set you back about \$12. What if it could cost you, say, 12 cents? You might be willing to pay for wireless convenience if you find yourself waiting in an airport lounge or on the slopes at Vail without a phone line in sight.

Wireless Web connections over radio and cellular networks range from 4,800 bps to 9,600 bps—downright depressing when there are 56-Kbps modems, 128-Kbps ISDN lines, and super-fast cable connections. But IBM is betting that people will both compromise on speed and spend a little more money for the sake of convenience. Just think about it: No crawling behind beds in hotel rooms to reach the phone connections. No scrambling to find a line to connect back to the ranch while you're visiting a client.

IBM has designed its new Web Express software to reduce by 70 to 95 percent the amount of data transmitted over the Web, to make slow wireless connections more efficient. The software relies on three techniques: compressing, caching, and "differencing." IBM has applied for several patents on its so-called "differencing technology," which transmits only changes made to a site since you last visited it.

Web Express's target user is the businessperson who frequently revisits sites and is not a Web surfer. For a frequent visitor to the *PC Magazine* Web site, the software would download only new stories and graphics and would access previously downloaded material from the cache. The user would then be able to catch up off-line while on the go.

On the hardware side, you'll need a modem card connected to your cellular phone or a card with a built-in radio-frequency modem. The software works with any type of wireless network, including packet data, analog cellular, or GSM, the cellular system that's deployed primarily in Europe.

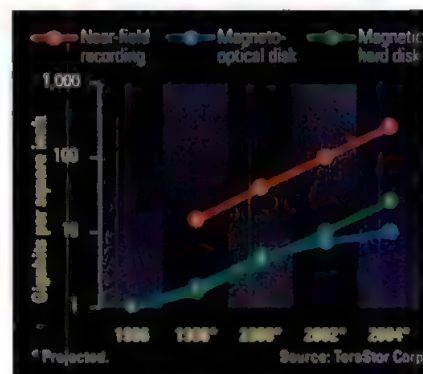
The Next Big Thing in Storage

It seems as if every new approach to mass storage is billed as the ultimate hard disk replacement; now a brand-new solution is inspiring some especially bold forecasts. Near-field recording (NFR)—a new technology that borrows from magnetic disk and magneto-optical technologies—offers 10 times the capacity of hard disks, at comparable speeds and costs.

TeraStor Corp., a San Jose-based start-up that's working on near-field recording, claims that the hard disk as we know it could be on its way to obsolescence within a year.

Near-field recording devices (developed first at Stanford University and subsequently at Digital Equipment Corp. and Quantum Corp.) employ media platters that are similar to those in a hard disk, as well as a low-flying read/write head modified from those of hard disks. The head includes optical elements

such as a magneto-optical head and a solid immersion lens (SIL). The solid immersion lens enables each bit cell of data recorded onto the platter to be much smaller than with hard disks or magneto-optical technology, thus allowing more data on a platter: 12 gigabits per square inch, versus a typical



hard drive's 1.2Gb.

The first NFR drives, due in the spring of 1998, will deliver 20GB of storage in one-platter designs. With such capacities, NFR drives could be ideal candidates for workstations and network servers. The drives will fit in standard 5.25-inch bays, and they'll be available in both fixed and removable formats.

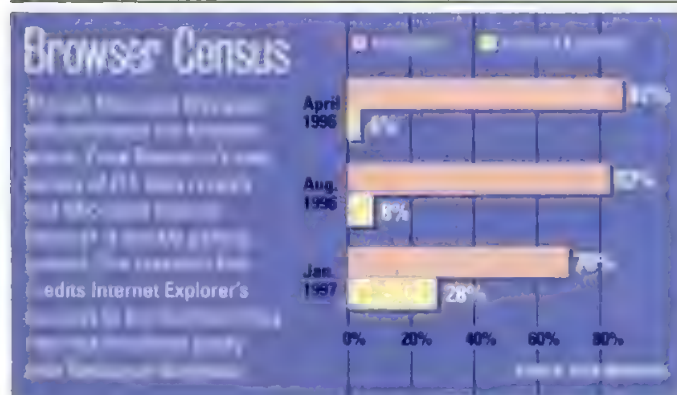
Desktop Screammers

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Join us online to see just how fast the fastest desktop systems ever (featured in this issue) really are. The Interactive Benchmark Test Viewers will allow you to slice and dice our performance test results any way you want, in order to analyze the relative merits of these very intriguing seven systems. Also featured at our Web site: the latest information on utilities for desktop publishing as well as photo illustration.

INTERNETUSER IS YOUR COMPLETE SOURCE: Our InternetUser section makes it easier than ever to access hundreds of up-to-the-minute Internet-related product evaluations. Clicking on www.internetuser.com will take you straight there.

ALSO ON THE WEB: Check in every day at our NewsWatch page to catch up on the latest Trends and news analysis. You'll also find late-breaking announcements of new products as well as NewsScan, our daily summary of computer coverage from the mainstream press.



Pipeline

The War over Net Access Fees

There's an argument raging over Internet access revenues, pitting local phone companies against the Federal Communications Commission. The Baby Bell phone companies argue that it's unfair that the FCC exempts Internet service providers (ISPs) from paying the same per-minute usage fees to local phone companies that long-distance carriers are required to pay. ISPs—such as AT&T's WorldNet service, which uses Bell Atlantic phone lines—say the local phone companies have no right to the extra revenues.

In late 1996, the FCC issued a Notice of Proposed Rulemaking that denies the request of local phone companies to impose access charges on Internet and other enhanced service providers. The FCC cites "the potentially detrimental effects on the growth of the still-evolving information services industry" as its reason for blocking the Baby Bells from charging per-minute Internet access fees.

The Internet Access Coalition's position is that allowing the Baby Bells to charge the access fees would "impede the continued growth and success of the Internet." The FCC has not set a date for its final decision, but the issue is closely watched. The Internet Access Coalition's "What You Can Do" page at www.internetaccess.org/action.htm offers suggestions for expressing your views to the FCC and Congress.

Wink into the Web

Believe it or not, cellular phones and beepers may start sprouting tiny screens that can display e-mail, Web pages, and even



CYBER DISPLAY: Kopin's 0.25-inch active-matrix display may one day be built into cellular phones.

video. Engineers at Kopin Corp., a semiconductor and digital imaging device developer based in Taunton, MA, recently debuted what they're calling "the world's smallest, highest-pixel-density fast-performance 0.25-inch active-matrix liquid crystal display."

The Kopin Cyber Display runs at a resolution of 320-by-240

pixels and measures only 0.25 inches diagonally—which seems rather tiny for any kind of viewing. But while the display itself is miniature and can be positioned as close as 3 inches from the eye, when viewed through a so-called "optical engine" that comprises a magnifying lens, the image appears as if it's displayed on a 20-inch-diagonal screen from a distance of 5 feet.

How does the company manage to shrink a screenful of information so dramatically and slap it onto a 0.25-inch display—all while consuming a mere 50 milliwatts of power? The electronics are contained in a sliver of glass etched using a super-exacting lithography process. Kopin engineers have come up with a process for "peeling" the circuitry from silicon wafers and transferring it to glass while producing factory yields of 50 percent, excellent compared with the low yields, caused by contamination, for which LCD manufacturing is notorious.

By the year 2000, suggests Kopin, you'll be able to get a pair of eyeglasses with the display circuitry built right in the frame.



Cyrix's Cost-Cutting Chip

Computer makers are tapping into the vast market for low-cost computers with the help of a low-cost microprocessor from Cyrix. Designed for the sub-\$1,000 PC market, Cyrix's new MediaGX processor—used in Compaq's new Presario, reviewed in this issue's First Looks—is the first x86 CPU to integrate a graphics accelerator, an audio subsystem, a PCI interface, and a memory controller. The chip's 133-MHz version sells for only \$99, provides full Windows functionality, and, according to Cyrix, matches the performance of a 133-MHz Pentium. A 166-MHz Pentium with MMX costs \$407. (The MediaGX does not offer MMX features.)

Using Cyrix's Virtual System Architecture (VSA), the MediaGX replaces graphics controllers and sound cards with on-board software instructions. These instructions are implemented via three trademarked technologies: XpressGraphics, XpressRAM, and XpressAudio. Bypassing the system bus and taking advantage of the processor's core clock speed, XpressGraphics is designed for high-end graphics acceleration and compression. Likewise, XpressRAM accesses memory directly and delivers the performance of an L2 cache without the cost of an L2 cache. The chip also offers Sound Blaster compatibility via XpressAudio.



Barney with a Beeper

Microsoft debuts a new breed of toy with the launch of its ActiMates Interactive Barney (\$99) this summer. With a PC Pack (\$59), Barney can communicate with specially encoded videos and with Microsoft's educational Barney CD-ROMs. Thanks to a radio-frequency signal transmitter box on your PC, Barney comes alive to lead a sing-along or react with motion and dialogue synchronized with on-screen events. His vocabulary: 14,000 words.



POWER PACK: The ActiMates PC Pack for Interactive Barney comes with a radio transmitter.

Top-Selling Business Software

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- 2 Norton AntiVirus Symantec
- 3 Viruscan McAfee
- 4 Microsoft Office Professional 97 Upgrade Microsoft
- 5 First Aid Deluxe Cybermedia
- 6 Corel WordPerfect Suite Upgrade Corel
- 7 Netscape Navigator Personal Edition Netscape Communications
- 8 Uninstaller MicroHelp
- 9 Norton Utilities Symantec
- 10 Microsoft FrontPage Microsoft

Source: PC Data. Data for January.

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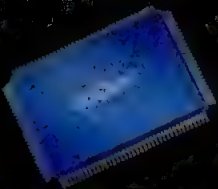


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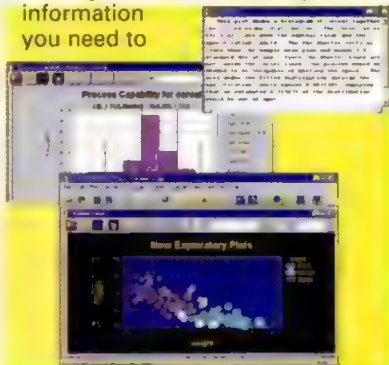


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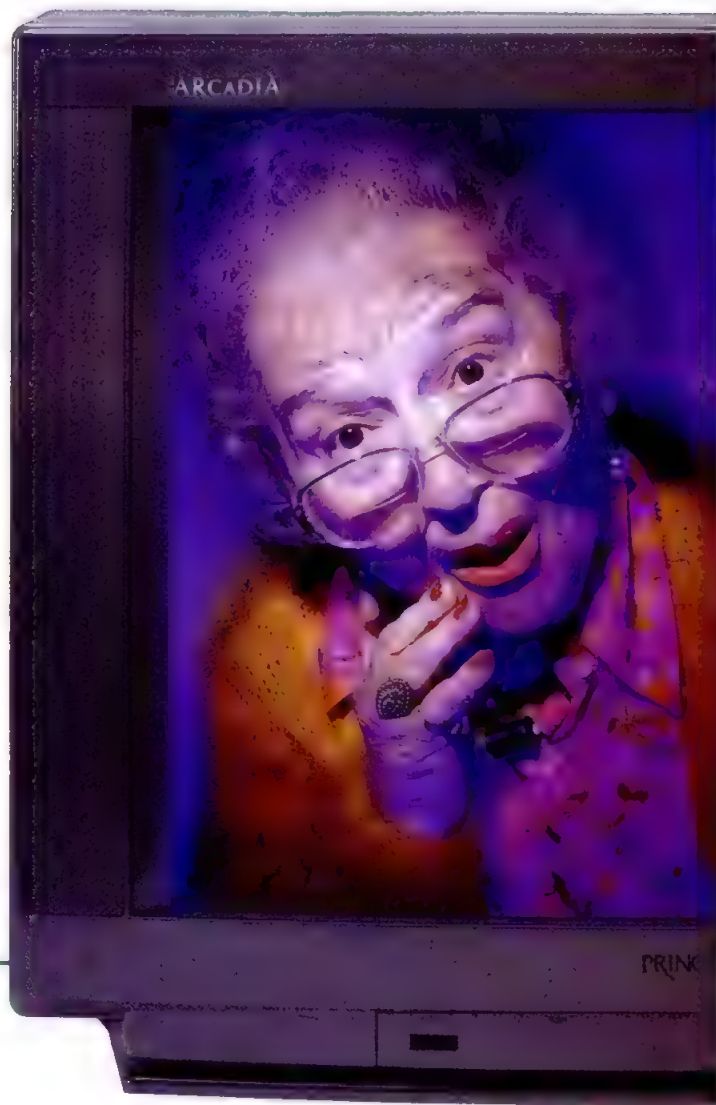
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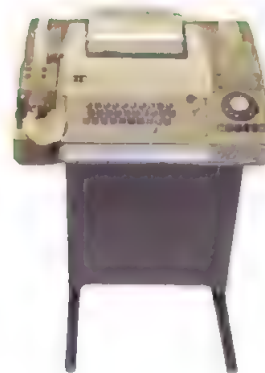
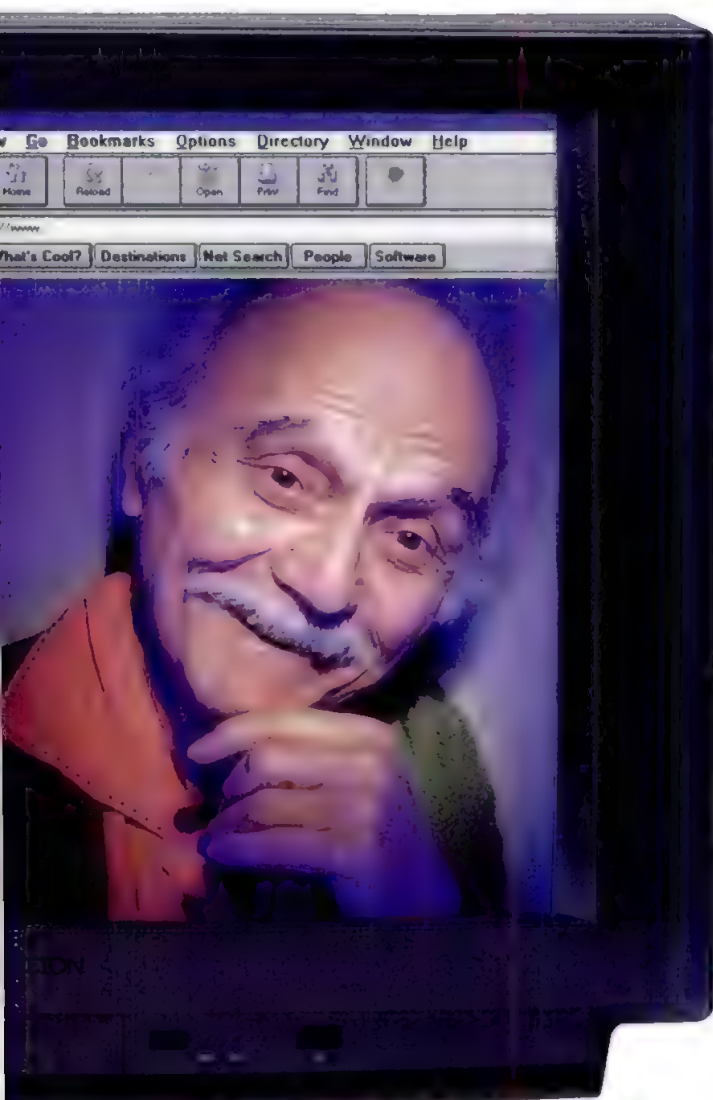
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Letters

TRUE VALUE

I want to compliment you on "Affordable, Portable Notebook PCs" in the January 21, 1997, issue. I have kept the article as a reference for the purchase of my first notebook. I keep going back to the article to compare *PC Magazine's* findings with articles in other computer magazines. The writing style and explanations for the testing procedures were extremely helpful to me in making my purchase decision.

DAVID STONE
via the Internet

Thanks for your thorough, detailed review of notebooks. Perhaps with the notebook market as it is today, this should be a more frequent feature. I would also suggest adding the number of memory slots to your Summary of Features table. At my company, we have found that although we always buy our notebooks with plenty of RAM to accommodate current and future needs, we always add memory after 18 to 24 months. With the one slot already occupied, it leaves little flexibility to install more memory.

ANDREW SCHNEIDER
Toronto, Canada

Your reviewer criticizes the best feature of the IBM ThinkPad 365X: the lack of a palm rest in front of its keyboard. In an informal survey, three of us who do a lot of writing tried out the author's preferred laptop with the extended palm rest in front—and rejected it. The shelf-in-front keyboards work in only two situations: typing with the machine in your lap or standing up with the machine in a computer store. But in a work situation, on a desk that's 26 to 29 inches off the floor, the palm shelf gets in the way of your hands.

CHARLES LAVE
via the Internet

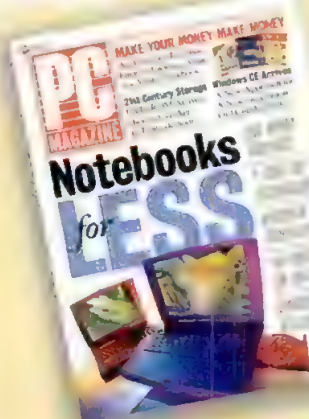
In future notebook reviews, please list the notebooks that have removable hard disks and the price for the additional drives. We would like to buy a minimal number of notebooks and have a separate hard disk for each person in our firm who travels.

MARK PALMER
via the Internet

AFFORDABLE DESKTOPS?

I found your reviews of the latest desktop systems ("MMX Extends the Desktop," February 4, 1997) interesting but of marginal use. How about reviews aimed at users like me, who can't afford the latest MMX technology? A review of desktop PCs in the sub-\$2,000 range is sorely needed.

AZIZ POONAWALLA
Boston, Massachusetts



*Thanks for your
thorough, detailed review
of notebooks.*

ROUND TRIP TO THE INTERNET

In the sidebar "When Is ISDN Worth It?" ("Digital Dragsters," February 4, 1997, page 147) you point out that using an ISDN line feels more than twice as fast as a modem connection and even faster than a T1 line that is shared among multiple users. This is largely due to lower latency (the round-trip delay of a small packet), which is important but rarely measured in performance reviews. An HTTP request requires several round trips before it starts to return data. Frames and in-line images multiply the problem, so latency rather than bandwidth limits is responsible for much of the Web's perceived slowness.

MIKE INGLE
via the Internet

It's true that there is a small (but measurable) difference among ISDN routers and adapters in terms of latency, which may be attributed to the processing power of each device. However, other factors affect Internet latency much more noticeably: namely, the amount of traffic on the network at any point between you and your destination and the responsiveness of the remote server that you are accessing. The main reason a 1.5-Mbps T1 line can feel slower than a dedicated 128-Kbps ISDN line is that you are usually sharing the T1's bandwidth concurrently with many other network users.—Ed.

PALMTOP PERFECTION

There is a lot of truth in John C. Dvorak's remarks about palmtop computers and Windows CE ("The Perfect Palmtop," February 4,

1997). I have been fascinated by palmtops but can't quite see the usefulness of these tiny devices—except for the U.S. Robotics Pilot, which has much more limited objectives. However, you tend to review from an American perspective, missing things going on elsewhere. In Tokyo recently, I saw what I consider the perfect palmtop: Toshiba's Libretto 50.

VERNON MOORE
via the Internet

Dvorak's dream machine won't be cheap, so it is not my dream machine. I don't want to pay for a desktop replacement that fits in my pocket.

WILL MARTIN
via the Internet

I think Dvorak hit a lot of nails right on the head when he described his perfect palmtop. He mentioned the voice notes utility, but I'm surprised he didn't go a step further and ask for full voice control. When voice recognition is ready for prime time, the need for keyboards (except as options) is going to plummet on all consumer computers and especially on palmtops.

STEVE JORDAN
via the Internet

How I wish the palmtop computer that Dvorak described in his column were a reality today! It certainly would simplify keeping track of the multitude of details that make up a typical day. If we could just get such a device this year for \$500, it would be a sellout in 30 minutes.

DAN CRUMPLER
via the Internet

PSIONS ARE PDAs, TOO

I was thrilled to see the Psion 3c featured in a sidebar in the January 21, 1997, PDA roundup (First Looks, "Psion: Past, Present, and Maybe Future of the PDA," page 47).

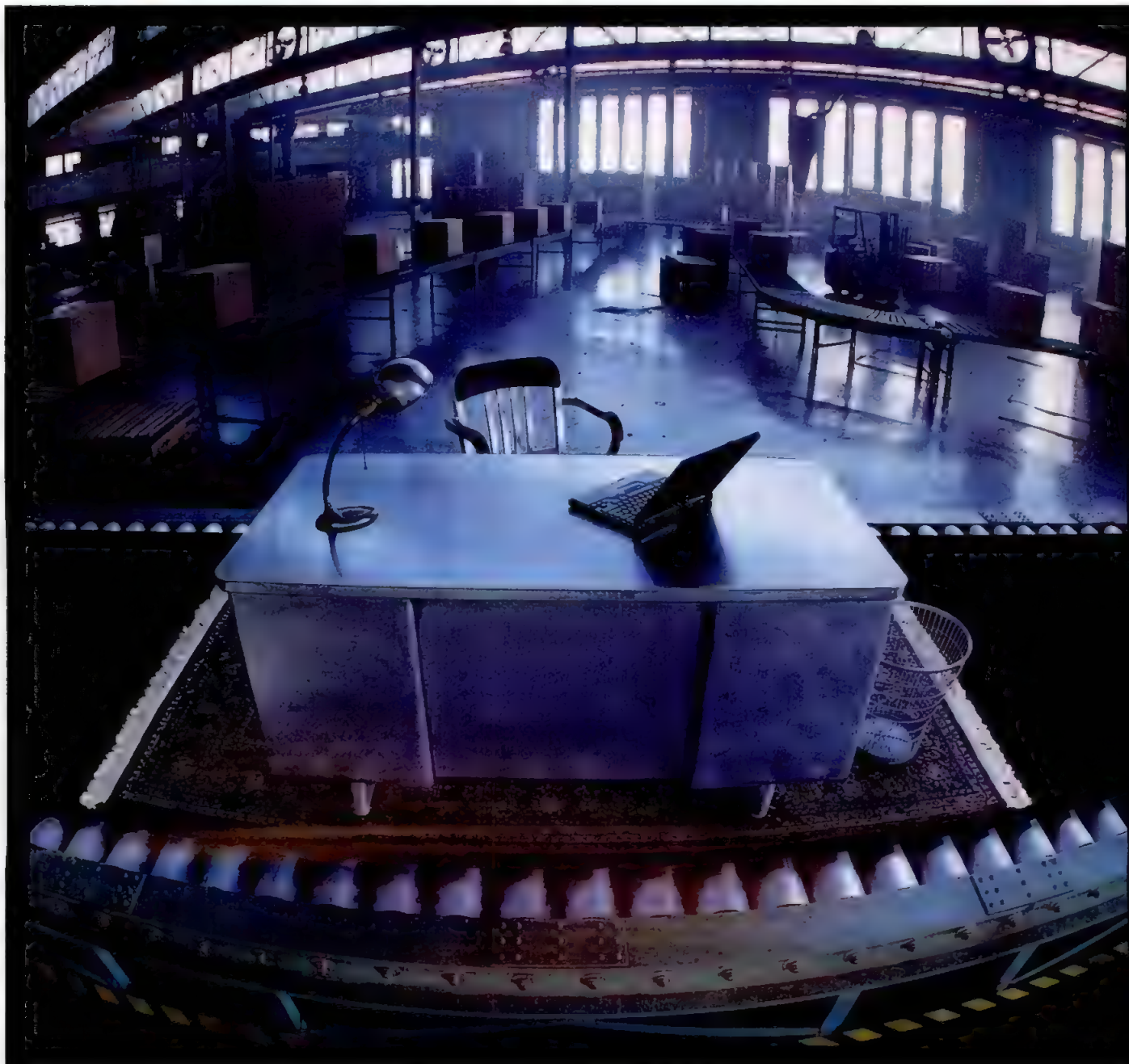
R. STEVE WALKER
via the Internet

I liked your piece on the Psion 3c. I've had a 3a for some time and recently went back to it after a half-year fling with the Pilot. I find it easier to enter information into and a little more robust when it comes to searching.

CHUCK HUMBLE
via the Internet

In your Counterpoint sidebar about the Psion PDA you said, "But there are hundreds of Psion programs, ranging from screen savers to personal finance and database managers." This begs the question: Do tiny LCD screens need saving?

GABI LOPEZ-BETANZOS
via the Internet



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Letters

WINDOWS NT SCANNER DRIVERS A MYTH

Jim Seymour's column "Scanner Myths and Secrets" (February 4, 1997) was quite interesting, but he failed to cover the topic that has been plaguing me since I decided to replace my ScanMan256. I have gone from Windows 3.1 to Windows NT 3.1 to NT 3.51 to NT 4.0. There has never been and—if Logitech has its way—never will be a scanner driver for Windows NT. This attitude seems to be pervasive among scanner makers. Many are now supplying Windows 95 drivers, but unlike the situation with other peripherals, not even Microsoft is supplying scanner drivers for NT.

RICH WEAVER
via the Internet

I was somewhat puzzled by Seymour's column, as he failed to mention Hewlett-Packard scanners. Does he have something against HP scanners that I should know about? Another magazine rates the HP 4P flatbed scanner as a "best buy," but it doesn't even get mentioned in his column.

STEVE MISHKIN
via the Internet

UPDATES AND PATCHES

To expand on Michael J. Miller's February 4, 1997 column ("The Quick Fix"): I think that another reason for the rush to distribute unproven software is the perceived need to be first. Life has accelerated, and vendors are afraid that someone will beat them to market. The "ship it now and fix it later" attitude is just another version of the psychology that gave us vaporware.

GARY JACKSON
via the Internet

HOW TO CONTACT US

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We regret that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.



CORRECTIONS AND AMPLIFICATIONS

In "Grand Designs" (March 4, 1997), within the sidebar "Enterprise Web Authoring Tools" on pages 106 and 107, the screen shots for Microsoft Visual InterDev and NetObjects Fusion were switched.

The photos of the network computers reviewed in the March 4, 1997, First Looks article "NCs: Fact or Fiction" should have been credited to Geoffrey Nelson. The illustration in the February 4, 1997, Second Looks article "Corporate Windows Washer" should have been credited to Marc Cohen.

I agree with Miller's idea of using the Internet to update programs. I had a good chuckle, though, when I read that "once you have registered, the company can notify you by e-mail whenever a new version becomes available." Does this really happen? I have registered every new program I purchased over the last two years and have received only two updates, both from Microsoft and both regarding the "New Microsoft Network" program.

GORD KUNZ
Edmonton, Alberta, Canada

TOO MUCH POWER?

I disagree with Bill Howard when he says that "excessive power doesn't have any downside" in the PC universe ("The PC Adviser," February 4, 1997). Setting aside the philosophical point that states "excessive = more than needed = waste = bad," there are some practical problems. One of my favorite games stopped working once I stepped up to a more powerful machine. The programmers admitted the game simply couldn't be made to work on the faster system. More important, excessive power leads to a vicious circle where programmers feel they don't have to write tight code because there's power to spare.

JIM HARRIS
Ottawa, Ontario, Canada

I have at least three family members who want to get a PC. The best machine for them has nothing to do with splitting hairs over 180-MHz versus 200-MHz CPUs or any other arcane hardware trivia; they will receive no value from those things. The best vendor for these PCs will be the one that provides support to nontechnical users.

JACK A. HUMMER
San Diego, California

I truly appreciated Howard's column "The PC Adviser." I am looking at buying a new computer in the near future and found his opinions mostly on a par with mine.

CORNELL BROEDERS
via the Internet

LIGHTER SIDE NOT TAKEN LIGHTLY

With regard to the first item in "Abort, Retry, Fail?" in the January 7, 1997, issue ("Every Visitor to France Has Experienced This Attitude"): For every English-speaking person forced to deal with a program in French, I'm sure you can find thousands of French people

forced to deal with a program in English.

LAWRENCE J. KRAKAUER
Waltham, Massachusetts

MAD ABOUT RAD

I was disappointed with the "RAD" C++ compiler reviews in your February 4 issue. While most of the reviewed compilers are indeed RAD, your top choice, Microsoft Visual C++, is a typical C++ compiler, not any more RAD than ones you neglected. For example, how can you justify including Microsoft's Visual C++ without reviewing Borland C++ 5.01? It offers similar tools, such as code- and object-generation wizards, and similar power. If you objectively compared Visual C++ with Borland C++ or Watcom C++, I don't think that Visual C++ would be your Editors' Choice.

MARK BURKARD
via the Internet

I would like to thank you for your article on C++ compilers. However, I was dismayed by the omission of several other compilers. I find it ridiculous to review three compilers and give your Editors' Choice to two, especially if there are several more compilers yet to be released.

DANIEL LYONS
Albuquerque, New Mexico

HAPPY LEFTY

As a member of the illustrious minority of left-handed people, I acknowledge with pleasure your artist's handshake in the illustration accompanying your Trends column "Stay Tuned for HDTV" (February 4, 1997). Whether this came about intentionally or was an error, it is nice to see a sinister handshake for a change.

RON JOHNSON
Suffern, New York

TRANSIT AUTHORITY

I was very interested in the January 21, 1997, Tutor column "Mass Data Transit." I had just replaced both my desktop and laptop computers and needed to move large files without using external devices such as an Iomega Zip drive or tape drives. The article was very well written and concise. The information may be well known to some people, but to others, like me, it was new and informative.

JOHN M. HARMON
Windsor, Connecticut

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Innovative FullScreen™ technology allows these 21" systems to provide a full square 19.7" workspace. Workers can gaze on a 1600 x 1200 wall of pixels whose dot pitch is a mere .22 x .16 mm.

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In fact, Nokia is the first manufacturer to fulfill the new VESA standards for display clarity (thereby "future-proofing" your decision). But while the Nokia maximums are impressive, their optimums are their glory.

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"over-specing". That way, the productivity gains of a high-performance monitor don't come at the heedless expense of your equipment dollars. This is the true price/performance equation. Now you can enjoy it and still keep rigorous adherence to new TCO'95, EnergyStar, and MPR-II standards.

Additionally, the 445Xav model comes with an integrated spatial sound speaker system, a must for anyone working with multimedia materials. And the 445Xavc model

adds a color video camera for image capture, teleconferencing and collaborative computing.





If you are preparing to upgrade or update your imaging hardware, you owe it to your entire organization to consider the 445X series. If you're not evaluating Nokia for your next imaging application, you might consider having more than your eyes examined.

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Trends



Shop till You Download

Software developers eye Web distribution.

While the computer industry is going like gangbusters, retail software sales are in a slump. Software distributors are struggling with flat revenues, hardware distributors are reluctant to stock new titles, and new titles are hard-pressed to get attention. Revenues from application sales in North America were \$2.4 billion in the third quarter of last year, a 19 percent drop compared with the same period the year before, according to the Software Publishers Association.

The story isn't all that bad. If you control for the spike in 1995's revenues driven by the release of Windows 95, the software market for last year turns out to be flat. But that doesn't inspire much optimism for retailers like Egghead, which has closed 77 stores, and for traditional distributors like Ingram Micro, whose market share has slid from 40 percent to 20 percent.

BIG BUSINESS OPPORTUNITY

All this is good news for the growing industry of electronic software distribution. According to industry newsletter SoftLetter, although only 1 to 2 percent of software is distributed electronically, that portion could grow to 33 percent by 1998. That's a \$5 billion market.

This opportunity hasn't been lost on several fledgling companies. Marimba, a pioneer in Web "push" technology, recently partnered with Corel to distribute Corel Office for Java

over Marimba's Castanet channel system. Castanet automatically installs the software from the Internet onto desktops, updating it as well.

Meanwhile, Release Software and Test-Drive compete in the "wrapper" department, providing the technology for electronically packaging software. Both companies do much of the behind-the-scenes work that enables Web retailers to distribute software electronically. Release Software, which is working with Egghead, Hewlett-Packard, Microsoft, Netscape, Starfish Software, and others, also provides distribution and transaction services to Web retailers.

ELECTRONIC APPLICATIONS

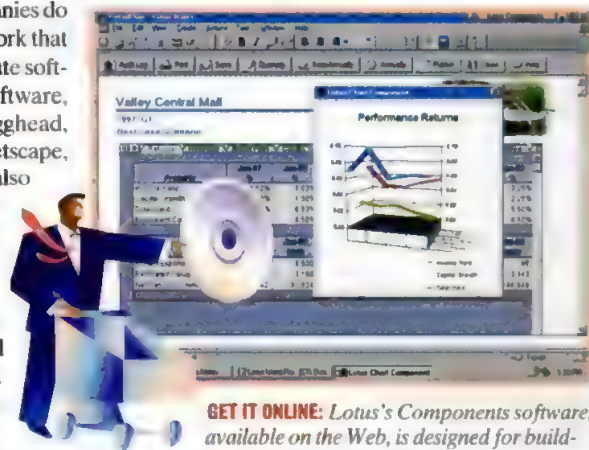
From components to full-blown applications, the Web is poised to become a formidable channel for software distribution. Lotus has released Components, a line of ActiveX and Java applets for charting, file viewing, drawing, spreadsheet analysis, and scheduling within Web browsers and Lotus's Weblicator. And it has as many as ten more products in the works, including a word processing applet, a data query and reporting applet, and a stripped-down version of Freelance Graphics. Although Lotus hasn't finalized a pricing strategy, it has talked about

pay-per-use pricing for its applets.

Other companies are experimenting with innovative approaches to distributing complete applications, such as word processors and image editors, on the Web. One start-up, Xoom Software, is charging a \$29.95 subscription fee to download a number of titles, including a word processor, a Corel spreadsheet, and an image editor. According to CEO Laurent Massa, Xoom is "experimenting with price points significantly lower than \$29.95 for a full suite of applications." Massa explains, "At low enough price points, desktop software can sell in huge volume on the Web."

Visual Components, which Sybase acquired last year, offers downloadable applets and full-blown applications, such as its \$79 spreadsheet Formula One/Net Pro. And Egghead's Web site has a dozen titles that you can purchase and download, including e.g. software's WebTrends and Starfish Software's Internet Sidekick.

The move toward electronic software distribution is also good news for small software developers that can't compete with Microsoft for shelf space. "The current distribution system works for Microsoft," says Agnes Imregh, CEO of Release Software. But the Web gives even small outfits exposure. For instance, developers of Quark Express extensions can electronically distribute their software from the new Web site xtension.com. Says Jacques Viker, president of Vision's Edge, one of the largest XTension de-



GET IT ONLINE: Lotus's Components software, available on the Web, is designed for building applets that extend Notes functionality.

velopers, "With hundreds of XTensions out in the marketplace, it's hard for us to let every single XTension of ours rise above the noise level." The Web offers a level playing field, so even niche players can get instantaneous global distribution for their software.—Carol Levin and Sebastian Rupley

Pay-per-Play Web Games

Game services nix subscription pricing.

The online pricing wars rage on, only this time we're not talking about America Online, CompuServe, or Prodigy. The combatants in this battle are the online game services. Unlike the online service providers that charge a monthly fee, some online game providers are exploring pay-per-play pricing as well as free, advertising-supported models.

Engage Games Online launched its game service in March on a pay-per-play basis. According to president Jeff Leibowitz, "The subscription model simply does not work for games." Instead of charging a monthly membership fee to play games such as Descent II and Warcraft II online, Engage will charge either \$1.95 per hour or, for an "advertising-free gaming experience," \$2.50 per hour.

Engage made its move a week after Mpath Interactive announced that it would adopt an advertising-only revenue model for its Mplayer game service. Mpath president and CEO Paul Matteucci says he didn't want Mplayer to be at a pricing disadvantage, especially when compared with free online game services such as Blizzard's Battle.Net and Westwood Studios' Westwood Chat.

Bob Huntley, president of Dwango, one of the older, non-Internet-based game services, says that Mpath's pricing move was "the smartest thing they could do" and a sign of things to come in the online gaming industry.

"The hottest growth area next year will be gaming," says Pete Higgins, Microsoft group vice president of interactive media. He describes the Internet Gaming Zone, which Microsoft acquired last year, as Microsoft's well-kept secret. The service—which Microsoft relaunched in March—matches up online opponents to play games, such as Monster Truck Madness, that they've bought at stores. The Zone plans "made for the medium" and "massively multiuser" games. Although its classic games are free, this summer it plans to offer a lineup of pay-per-play premium games.

According to industry analysts, the online game market is on the verge of enormous growth. But right now, the market is far too young to indicate whether or not an advertising-only model or a pay-per-play model will succeed.—Michael E. Ryan



A License You'd Like to Lose

IN THE PAST, PC LABS TESTS COMPARING RISC-based systems to the fastest x86-based units revealed that the RISC machines outperformed the PCs by a fair margin. They also showed that the Unix systems presented considerable setup and administration challenges. As you'll see in this issue's story "Workstation Wars," things have changed. New x86 systems are now powerful enough to compete head-to-head with RISC systems in many areas. Likewise, RISC workstations have friendlier interfaces, better online help, and simpler administration utilities.

Although all of these developments are encouraging, don't think that installing applications on a new workstation is a walk in the park. We quickly learned how cumbersome, archaic, time-consuming, and expensive the process can be. Setting up AutoCAD, AVS Express, Photoshop, and PV-Wave costs \$5,000 to \$6,000 per seat; installing Softimage 3D Extreme costs \$13,995 per seat.

We found that the applications' use of certain licensing and copy protection methods was a significant obstacle in our testing. Although we recognize that piracy is still a very big problem, current licensing and copy-protection methods often cause hours of frustration for honest end users and significantly increase demand for tech support. We spent at least one quarter of our time debugging licensing problems rather than testing workstations.

SPECIAL AUTHORIZATIONS

Case in point: Of all the packages that we tested, AutoCAD employs the least intrusive licensing method, but users still cannot unlock the software without entering a long serial number and then calling Autodesk to obtain an authorization code. A full-blown installation of PV-Wave requires a 28-digit code, a 1- or 2-digit checksum, and a 9-digit date for each of the nine modules. And since Photoshop didn't

automatically update license files on the Silicon Graphics system, we had to enter lengthy strings into the data files of FLEXlm—the most popular workstation licensing product, from Globetrotter Software—manually. If you add an extra space or type a letter in the wrong case, then nothing works.

Our Softimage installation across the systems from Compaq, Digital, Hewlett-Packard, and Silicon Graphics was nothing short of a horror show. After three days on and off the phone with Softimage and workstation tech-support personnel, we finally got the software to work.

What's more, not only does Softimage employ FLEXlm, but it also uses a dongle. Although dongles may provide you with added copy protection, they can also cause odd parallel-port behavior. To add to our troubles, our SoftWindows license expired on the SGI machine during the middle of testing, so we used an automated e-mail feature to ask for an updated license from SGI. Because our subject line said *License* instead of *license*, our request was rejected.

LEARN THE RULES

Workstation users and administrators brave enough to enter this world should become familiar with the rules and regulations of applications' protection schemes. It's also a good idea to keep backups of license files, to know the expiration date of each of your licensed applications, and to be sure that your applications know where to find the licensing files. In addition, make sure that you have your Windows NT installation disks handy, because chances are you'll find your TCP/IP stack corrupted by the licensing procedure at some point and you'll need to reinstall. Finally, don't expect to understand some of the FLEXlm error messages, because they're incomprehensible.

After our nightmare with licensing procedures, we all need a good night's sleep.

INSTALLING SOFTIMAGE
ACROSS THESE
WORKSTATIONS WAS
NOTHING SHORT OF
A HORROR SHOW
WE SPENT THREE
DAYS ON AND OFF
THE PHONE WITH
TECH SUPPORT.

56-Kbps Modems: Are They for Real?

The first models are shipping, but standards skirmishes still loom.

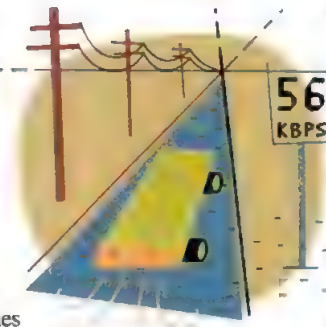
As part of the recently announced merger between networking hardware maker 3Com and modem maker U.S. Robotics, 3Com will acquire U.S. Robotics' line of 56-Kbps modems. Although the acquisition has drawn attention to this new breed of high-speed modems, questions are swirling about their viability. Lack of a single industry standard, possible incompatibilities, and legal issues loom, even as more companies latch onto the technology.

Lucent Technologies, Rockwell International, and several other manufacturers have announced 56-Kbps products for delivery this year; Rockwell will supply chips to several modem manufacturers, including Diamond Multimedia, Hayes, and Microcom. While Lucent is banking on Rockwell's 56-Kbps technology, U.S. Robotics is pursuing its own technology and is licensing it to at least two other modem makers, Cardinal and Logicode.

Skirmishes have already broken out over who owns which standards. Motorola has sued U.S. Robotics for alleged infringement of patents applying to 56-Kbps modem technology. Worse, there are no guarantees that the manufacturers' technologies will be mutually compatible.

There is a ray of hope for an international 56-Kbps standard, to be set by the International Telecommunications Union (ITU). It's likely to require software upgrades for existing 56-Kbps modems, however. Analysts warn that buyers should make sure these upgrades are possible before purchasing the modems.

PC Magazine has already conducted informal tests on the first 56-Kbps modem to



ship: the U.S. Robotics Sportster Faxmodem with x2. Although the units we tested weren't able to connect at 56 Kbps, they did reach download speeds of 46.66 Kbps over a standard phone line. (Note that these high-speed connections involve only downloads.) And Web surfing was subjectively as speedy with the U.S. Robotics x2 connection as with a single 64-Kbps ISDN connection. PC Labs will test the modems for official throughput numbers over the coming months.

Although our first experience with 56-Kbps modems was positive, many observers remain gloomy. U.S. Robotics and other companies are confident that growth in Internet access will fuel success for the new products, but according to Dirk Gates—CEO of Xircom, a maker of modem and networking cards for notebooks—"the whole modem market will have a tough year" if there is no clear standards agreement.—*Sebastian Rupley*

JAKE KIRCHNER

Turning Up the Volume in PC Sound

How poor is your PC's sound system? If you haven't given it much thought, you probably will soon, as Creative Labs—whose Sound Blaster sound cards and chips own most of the market—gets into the full swing of a \$50 million marketing campaign. The company wants to persuade you that whatever sound system you have—even an earlier-generation Creative product—is merely a shadow of what you need and deserve.

The mammoth campaign will use ads, direct mail, and a panoply of special gimmicks, including a Web-based contest that will feature the giveaway of half a million dollars in gold ounces. It's designed to support Creative's next-generation Sound Blasters, the AWE64 line, which the company recently introduced.

"Audio is the most important medium in a personal computer," argues W. H. Sim, chairman and CEO of Creative Technology, Creative Labs' parent company, "but the base audio of your system is just not good enough."

"Not good enough for what?" you might ask. From Sim's perspective, all PC applications, from today's games and Internet-based multimedia programs to tomorrow's desktop videoconferencing and DVD titles, demand high-fidelity sound. Today's high-powered Pentium systems deserve such sound, he says, suggesting that any other approach is like buying a BMW and installing only an AM radio.

Sim also knows that if you're willing to spend 1 or 2 hundred dollars to upgrade your sound card, you'll probably be willing to invest in better speakers. Not coincidentally, Creative has just bought almost 20 percent of speaker maker Cambridge SoundWorks, and it will be



incorporating Cambridge's speakers and audio technology throughout its product lines.

It's a sure sign that the PC business has reached maturity when a company known primarily for inexpensive upgrade kits is able—and willing—to launch the kind of promotional effort that used to be reserved for operating-system upgrades and new office application suites.

Why not? Creative has grown to be a billion-dollar enterprise on the strength of those upgrade kits. Through retail sales and agreements with PC makers such as Dell, Hewlett-Packard, Micron, and NEC, it has more than 40

million Sound Blaster users. And most of the 70 million PCs sold every year are shipped with sound capability, resulting in a tremendously large market for even those high-margin items that have low prices, such as sound and graphics cards and CD-ROM drives.

It's not clear how many of us are going to spend 3 to 5 hundred dollars on new sound cards and speakers, but it's true that the sound in most PCs is pretty pathetic. Although most of us are reasonably happy with our current sound cards—such as the popular Sound Blaster 32, which features an 82-dB signal-to-noise ratio and 0.1 percent total harmonic distortion—sound quality improves enormously with a card such as the AWE64 Gold, with its 90-dB S/N ratio and 0.01 percent THD. And the new PCI cards entering the market promise even more significant advances in the next year or two.

Creative Labs believes it can sell PC sound the way Nike sells shoes and Starbucks sells coffee. Sure, you can get by with less expensive shoes and coffee, but how cool would that be? Creative is betting \$50 million that you'll agree that your current PC is definitely uncool.



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SERVERS

By Sixes and by Eights

While the Pentium Pro is facing a stiff challenge from MMX-enabled processors in the mainstream desktop arena, its role in the server market—which takes advantage of the Pentium Pro's built-in SMP (symmetric multiprocessing) capabilities—continues to widen.

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Digital's Priors line of servers.



Advanced Logic Research (ALR), Corollary, Dell Computer Corp., Digital Equipment Corp., Micron Electronics, and NCR Corp. have all have introduced new Pentium Pro servers.

ALR (800-444-4257, www.alr.com) introduced its **ALR Revolution 6x6**, a server with six 200-MHz Pentium Pro processors and 512K of onboard secondary cache per CPU. Starting at \$14,995, this system is compatible with all x86-based multiprocessor operating systems). The Revolution 6x6's enclosure houses six drive bays that support 1-inch SCA or 1.6-inch Fast/Wide SCSI devices, three 3.5-inch drive bays, and five 5.25-inch drive bays. One of the 5.25-inch bays contains a 6X SCSI CD-ROM drive.

The server also provides a redundant-power-supply subsystem (two 350-watt main devices and one 350-watt spare) and 12 expansion slots (seven 32-bit PCI, four 32-bit EISA, and one shared PCI/EISA slot). The entry-level price in-

cludes 128MB of ECC memory.

The server's motherboard hosts two Tri-6 CPU cards, each of which accommodates a three-processor-ready SMP bus. These two buses then plug into a third 64-bit SMP bus, which according to ALR provides the performance of a parallel-bus architecture but avoids thermal and electromagnetic problems.

Corollary (800-338-4020, www.corollary.com) and NCR (800-447-1124, www.ncr.com) have both developed eight-way server solutions: the **Profusion** and the **OctaScale**, respectively. The Profusion—which interconnects two Pentium Pro buses without inserting a bus in between—has already been licensed to Hitachi and Samsung (Corollary ships to OEMs only); these vendors expect their eight-way Pentium Pro servers to be available this summer.

NCR's OctaScale uses a slightly different design, with the same result. The OctaScale uses an additional bus to join two SHV (standard high volume) boards and allows for independent paths between each chip and I/O and memory. It will debut by mid-year in NCR's **World-Mark 4300** servers and in machines from Sequent Computer Systems.

At the midrange end of the market, Dell Computer (800-289-3355, www.dell.com) offers its **Dell PowerEdge 4100**, a single- or dual-CPU Pentium Pro server that starts at \$6,199. This system, which is available in both 180-

and 200-MHz processor configurations, offers a rack-mountable tower chassis with ten front-accessible drive bays (four 5.25-inch and six 3.5-inch), a Dell Remote Assistant management card for out-of-band server management, redundant cooling, and a single 500-watt power supply. A redundant, hot-swappable power supply is optional.

The PowerEdge 4100 (\$6,199) ships with a 180-MHz Pentium Pro with 256K of L2 cache, 64MB of ECC DRAM, a 4GB hard disk, an 8X SCSI CD-ROM drive, and a Fast Ethernet adapter from 3Com Corp. A high-end \$11,399 version features two 200-MHz Pentium Pros with 512K of L2 cache and 128MB of ECC DRAM.

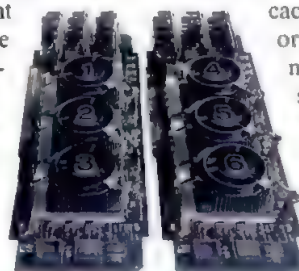
Digital (800-344-4825, www.windows.digital.com) has added two new products to its Priors line of Pentium Pro servers: the **Digital Priors XL 6000** and the **Digital Priors MX 6200**. Like the PowerEdge, these machines are meant to function as file-and-

XL 6000 comes with a 180-MHz Pentium Pro, 256K of L2 cache, 16MB of ECC EDO memory, five I/O slots, and nine drive bays. The low-end \$3,635 Priors MX 6200 includes a 200-MHz Pentium Pro with 256K of L2 cache, 32MB of EDO or fast-page-mode memory, seven I/O slots, and eight drive bays.

Lastly, Micron Electronics (800-438-3348, www.micronpc.com) has announced its own entry-level Pentium Pro office server. The **Micron Vetix LXI** supports either one or two 200-MHz Pentium Pro processors with 256K of L2 cache. The processors are located on a daughterboard, so upgrading to two CPUs is as simple as snapping in the second processor and its voltage-regulator module.

The Vetix LXI's motherboard also offers eight expansion slots, an integrated Adaptec 7880 PCI Ultra Wide SCSI-3 controller, and an Intel Ether-Express 10/100-Mbps Fast Ethernet controller. The system's case boasts nine drive bays (three external, six internal), a 12X SCSI-2 CD-ROM drive, and a 3.5-inch floppy disk drive. The server also ships with a copy of Intel's LANdesk Server manager, Version 2.52a.

The single-processor \$4,999 Vetix LXI system includes 32MB of ECC EDO DRAM and a 2GB Ultra/Wide SCSI-3 hard disk; a \$5,999 version increases memory to 64MB and hard disk space to 4GB. A dual-processor model with 128MB of memory and two 2GB Ultra/Wide SCSI-3 hard disks sells for \$6,899, and a high-end \$8,599 incarnation includes 256MB of memory and 4GB of hard disk space.—Cade Metz



REVOLUTION: The Revolution 6X6 motherboards, from ALR.

OFFICE SERVER PRO:
The Vetix LXI, from Micron Electronics.



print, Internet/intranet, mail, and application servers. Both systems can be used in Digital's standard 19-inch rackmount enclosures, and each includes an integrated Ultra Wide SCSI controller, a Fast Ethernet adapter, and a 12X SCSI CD-ROM drive.

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iCOMP Index 2.0

compares the relative performance of different Intel microprocessors



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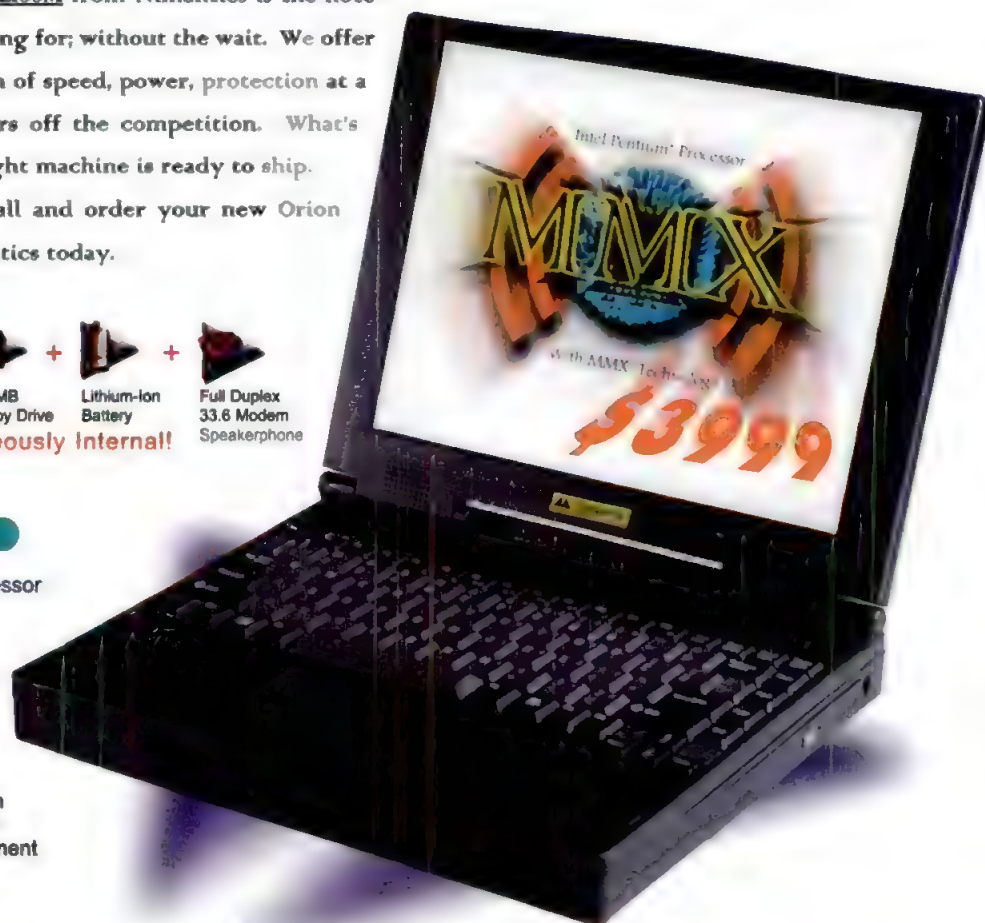
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WINDOWS CE

Synching with the New OS

With the emergence of Microsoft's operating system, Windows CE, comes the potential for a new brand of mobile professionals. This OS provides a standard platform for synchronizing data between desktop PCs and such hand-held devices as the Casio Cassiopeia and the Editors' Choice-winning Philips Velo. Five packages that are designed for Windows CE are helping to facilitate data synchronization.

IntelliSync for Windows CE (\$70 street) from Puma Technology (408-492-0387, www.pumatech.com) allows you to synchronize data that's stored in your Windows CE device with a variety of desktop personal information managers, including Symantec's ACT!, Day-Timer Technologies' Day-Timer Organizer, NetManage's ECCO Pro 3.03, GoldMine Software's GoldMine for Window 95, Lotus Organizer, Microsoft Schedule+, Starfish Software's Sidekick, and others. IntelliSync's data-translation engine irons out any wrinkles in the databases' formats and structural elements.

Along the same lines as IntelliSync is DataViz's \$75 **DeskTop To Go** (800-733-0030, www.dataviz.com), which also lets you synchronize PIM data between your desktop PC and Windows CE hand-held devices. The package currently supports ACT!, Organizer, and Sidekick, and there are plans to support Lotus Organizer 97 and Starfish Software's Sidekick 97.

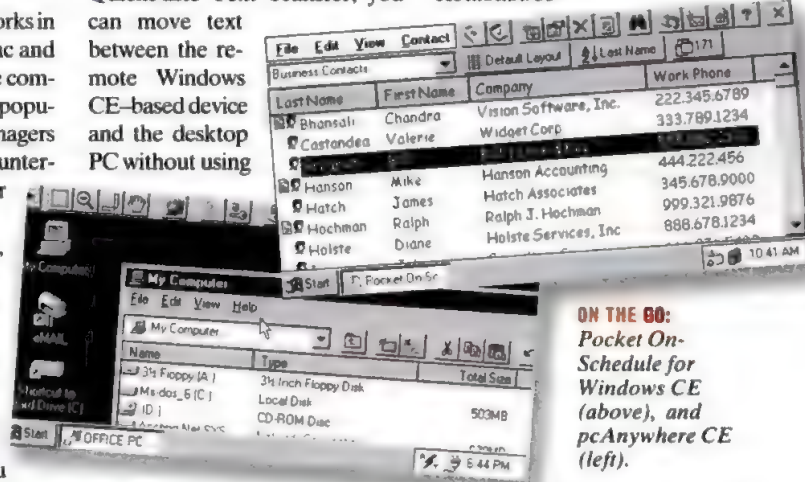
Pocket On-Schedule for Windows CE (\$70 street), from Odyssey Computing (800-965-7224; www.odysseyinc.com), offers a vast improvement upon the Information Manager that comes with Windows CE. Pocket On-Schedule provides such features as customizable layouts, multiple phone books, phone call and e-mail logging, and an unlimited number of databases. Optimized to work with Hewlett-Packard's palmtop PCs, the HP 300LX and HP 320LX,

Pocket On-Schedule also works in conjunction with IntelliSync and DeskTop To Go to provide complete synchronization with popular personal information managers and with its own desktop counterpart, On-Schedule 97 for Windows 95/NT.

pcAnywhere CE (\$40 street), from Symantec Corp. (800-441-7234, www.symantec.com), is a Windows CE-based communications product that provides remote control, text transfer, and new viewing technologies. With pcAnywhere, you

can remotely access data and applications from a PC, workstation, or network server that's acting as a host. And with the product's QuickPaste Text Transfer, you can move text between the remote Windows CE-based device and the desktop PC without using

filters—which means you can easily work with such apps that don't run on the Windows CE platform as Lotus cc:Mail.—Yvonne Koulouthros



ON THE GO: Pocket On-Schedule for Windows CE (above), and pcAnywhere CE (left).

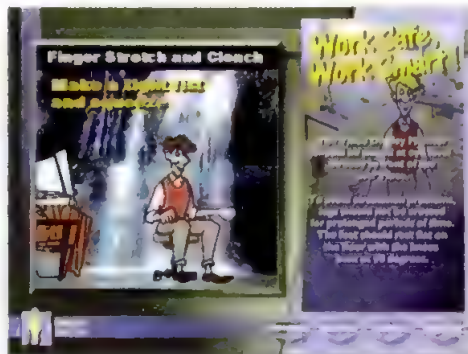
ERGONOMICS

Preventive Measures

You tap away at your keyboard all day. Sometimes hours can pass before you stop and take a breather. And it's not as if you're stopping three times in a paragraph to use correction fluid as you would with a typewriter. Repetitive motion from using your mouse and keyboard can cause repetitive strain injuries (RSIs), especially if your

approach to the same subject is Vanity Software's \$54.95 **ErgoBreak for Office** (800-643-2881, ext. 14; www.vanity.net). ErgoBreak explains the effects of RSIs and the legal issues surrounding these injuries. At user-customizable timed intervals, an icon pops up on-screen reminding you to take a work break. The software-induced break lasts 90 seconds and features colorful, animated characters who lead you through basic stretching exercises. You can also access a bulletin board-like area along the right edge of the screen, where you can post messages, company news, and more.

For those who can't seem to get enough of Scott Adams's inimitable *Dilbert* comics, there's Vanity Software's variant on ErgoBreak, the \$39.95 **Dilbert Break**. With Dilbert Break, your break reminder comes in the form of an memo from the Boss. And when you take a break, Dogbert, the Health Consultant, leads Dilbert, Wally, the Boss, and other *Dilbert* comic strip characters through ergonomic exercises. As a bonus, Dilbert Break includes a Dilbert screen saver and a section titled *Incredibly Time Wasting Games*.—Melissa J. Perenson



ERGONOMIC ASSISTANT: Vanity Software's *ErgoBreak for Office*.

work station is not properly setup.

Magnitude's **ErgoSentry** addresses the need to monitor time spent at your computer and offers a way to remind you auto-

matically when you should take a break (888-786-7774, www.magnitude.com). This \$44.95 package goes beyond simply monitoring the number of keystrokes you type in a given period. Instead, ErgoSentry logs your time at the keyboard and mouse as either a "work minute" or a "rest minute." With the user-customizable default settings, one work minute equals 45 keystrokes or 30 seconds of mouse activity; a rest minute is defined as five or fewer keystrokes per minute.

When you reach a total of 30 work minutes, the program automatically alerts you that it's time for a break. There are five levels of alerts, each informing you of the increasing need for you to pause. The alerts also provide stretching exercises on-screen for relaxing your hand and wrist muscles.

Taking a more light-hearted

Trends Peripherals

INK JET PRINTERS

Color Ink Jet Rumble

Within weeks of each other, printer giants Epson America (800-463-7766, www.epson.com), Hewlett-Packard Co. (800-752-0900, www.hp.com), and Lexmark International (800-358-5835, www.lexmark.com) rolled out their latest four-color ink jet printers.

Targeted at the home market, the **HP DeskJet 694C** (\$300 street), from Hewlett-Packard, delivers 600-dot-per-inch black-and-white printing at 5 pages per minute, and 300-dpi color prints at 1.7 ppm. The package includes the HP Photo Project

CD-ROM, which contains Storm Technology's Easy Photo for photo editing, Corel Print House Select 1.1 for creating cards, invitations, and calendars, and PrintPak's Awesome Iron-Ons for producing fabric projects. There's also a convenient sample-paper pack.

HP faces stiff competition from Epson's **Stylus Color 400**. Epson's new and improved Micro piezo technology achieves color-output resolution of 720 dpi, delivering what Epson heralds as photo-quality printing. The printer's engine is rated at 4 ppm in black and at up to 3 ppm in color, and the software bundle includes full versions of Adobe Photo Deluxe and Sierra Print Artist. All this for just \$230 (street).

RECAP In our November 5, 1996, roundup of personal ink jet printers, we picked the Epson Stylus Color 500 and HP DeskJet 870Cse as Editors' Choices.

DIGITAL CAMERAS

Pocket Cameras

More big names are getting into the filmless photo game. The newest entry-level digital cameras are ultra-small and targeted aggressively at the home and notebook set. Debut models from industry heavyweights Panasonic (800-742-8086, www.panasonic.com) and Toshiba Imaging Systems (800-550-8674, www.toshiba.com) are expected on store shelves sometime in May; Hewlett-Packard Co. (888-474-3867, www.hp.com) rolls out its entry this month; and digital-camera veteran Canon Computer Systems (800-848-4123, www.powershot.com) introduces a new model next month.

The most intriguing design of the current crop is the **Toshiba PDR-2A's** (\$500 street). This model, which weighs under 7 ounces with the battery, fits into a shirt pocket and has a built-in PC Card memory module that flips open like a small cellular phone to plug directly into a notebook

card slot. The camera shoots 640-by-480-resolution images at 24-bit color depth. Its stamp-size 2MB SSFDC (Solid State Floppy Disk Card) SmartMedia flash memory card stores up to 24 JPEG im-



ages in fine mode and 48 in standard mode.

The camera comes with Sierra Imaging's software, Image Expert, and Live Picture's LivePix. Options include a SSFDC adapter for desktop use and 4MB flash memory cards that hold 48 im-



Lexmark's latest offering, the **Color Jetprinter 2055** (\$300 street), is aimed at SOHO and business users. The printer is capable of delivering 600-dpi output at 5 ppm in monochrome and at 2 ppm in color. The bundle includes Lexmark's Photo Pak, a six-color ink cartridge for photo-

realistic output. Business users will appreciate the software package, Workshop Deluxe for Business, which includes the Sharkware Professional contact manager, Peachtree's accounting software, online business reference books from *Inc.* magazine, and more.—Toni Kistner

ages in fine mode and 96 images in standard mode.

Panasonic's first digital camera offering is the **Panasonic KXL-600A** (\$400 street). This 7-ounce camera saves 24 high-resolution JPEG images (or 95 in normal mode) either to a 2MB memory card or to your computer via the included serial cable. A second model, the **Panasonic KXL-601A** (whose price is not yet available) adds a 1.8-inch LCD.

POCKET SHOTS: Digital cameras from Toshiba Imaging Systems (above) and Canon Computer Systems (left)

Another newcomer to the digital arena is Hewlett-Packard, which is offering

the **HP PhotoSmart PC Photography System**, a soup-to-nuts solution that will include a digital camera, photo printer, photo scanner, photographic paper, and Microsoft Picture It! in a kit aimed squarely at the home market. The pieces of the puzzle will also

be available separately, starting with the PhotoSmart digital camera (\$400 street). The camera features a top resolution of 640 by 480 and a built-in flash, and it saves images to 2MB (\$50) or 4MB (\$75) HP Photo Memory Cards.

With the **PowerShot 350** (\$700 street), Canon packs all the features of its popular PowerShot 600 into a less expensive, pocket-size model. This 11-ounce unit has a resolution of 640 by 480, built-in flash, autofocus, red-eye reduction, and a 1.8-inch color LCD screen. It uses 2MB compact-flash memory cards to store 24 JPEG images in fine mode, 47 images in normal mode, and as many as 11 images in superfine mode. Software includes Ulead PhotoImpact SE as well as two proprietary programs from Canon.—TK

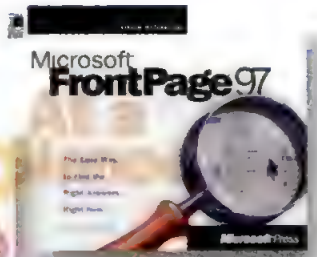
RECAP We reviewed 11 entry-level digital cameras in our issue of January 7, 1997. The Canon PowerShot 600 and Kodak DC40 were our Editors' Choices.



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JAVA WEB SITES

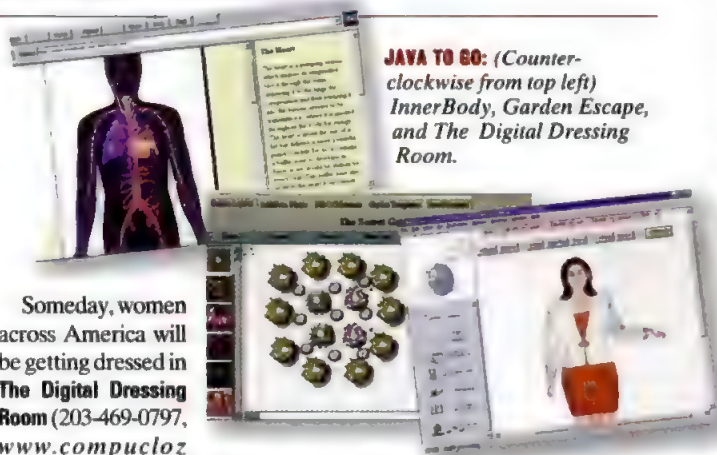
Not Your Ordinary Java

As so often occurs with promising technologies, the hype surrounding Java has far surpassed its practical application. In case you still need proof that Java can deliver more than yet another version of Tetris, look to the examples set by these three sites.

Indulge your topiary dreams with **Garden Escape** (512-494-2100, www.garden.com), a free, total garden-planning solution. This unique site provides an extensive horticultural database, an online magazine, and a chat forum. Most notable is the Garden Planner, a Java applet that lets you design your garden by dragging and dropping plant icons onto a grid map. You can choose a palette of

up to 25 plants, and when you're not familiar with a plant you can look up its specifics in a glossary. You can store the plants and materials you want in a virtual wheelbarrow and purchase them later from the site's garden center.

With **InnerBody**, Informative Graphics Corp. (602-971-6061, www.innerbody.com) brings a no-fee, no-download anatomy reference site to the Web. Using a well-organized, frames-based view, you can access illustrations, animations, and descriptions for anatomical systems, and flip through a general anatomy lesson. More lessons will be added, and future features may include quizzes and an area for kids.



JAVA TO GO: (Counter-clockwise from top left) *InnerBody*, *Garden Escape*, and *The Digital Dressing Room*.

Someday, women across America will be getting dressed in **The Digital Dressing Room** (203-469-0797, www.compucloz.com). Using this interactive applet, a woman can "configure" an avatar with her measurements, then try on dresses, jackets, and skirts online. The applet is still in development; improvements, including a version for men, will show up as the concept is licensed to retailers, department stores, and catalogs.

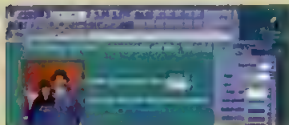
Originally created under Unix, the DDR was ported to Java with an eye on automatic updates and crossplatform compatibility. So far, bandwidth constraints have hampered these goals, but you can look forward to the day when you can get a true fit online. —Regina Kwon

HTML EDITORS

PageMill Bows

After a long wait, PC users can now experience what has been hyped as the hot HTML editor. Adobe has finally released a public beta version of its acclaimed WYSIWYG Web-authoring tool, Adobe PageMill 2.0, for Windows 95 and Windows NT (www.adobe.com).

Previously available only for the Macintosh platform, PageMill 2.0 accommodates everyone from the Internet hobbyist to the full-fledged Netizen. While building pages using drag-and-



drop, you can also view and edit the source code. Other features let you scale and color individual characters, and calculate the estimated download time of your pages. The program supports multimedia plug-ins for rich pages that contain .PDF images, QuickTime, and Shockwave files. —RK

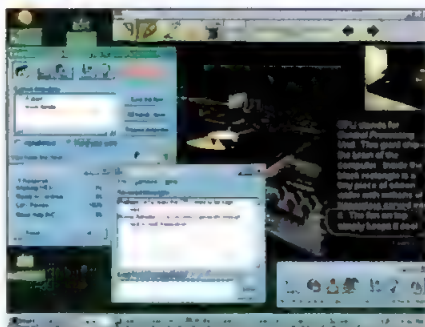
EDUCATION

Turn Your Browser into A Classroom

As the need for specialized, time-critical training in the global economy grows, companies can now turn to products that utilize the Internet as a replacement for the corporate classroom.

Asymetrix Corp. (800-448-6543, www.asymetrix.com) has released **ToolBook II Assistant**, a \$995 product designed to let trainers build courses without programming. You can create courses for the Internet or for traditional CD-ROM computer-based training (CBT). The Book Specialist wizard lets you design the basic layout of a course. You can then customize course specifics, such as the questions students are asked.

Centra Software (617-861-7000, www.centra.com) goes a step further with its live virtual classroom, **Symposium**. An enterprise solution for major companies, this Java-based program costs \$35,000 per server for 50 concurrent users (including one Symposium Course Builder license and unlimited use



TEACHING AID: ILINC's *LearnLine I-Net*.

of the client applets). Symposium, due out by midyear, runs as an applet within any Java-enabled browser. The Course Builder lets you integrate video, whiteboard functionality, and threaded discussions into a course. You can define rights access for the instructor and control who's speaking in class. Symposium replicates the classroom experience with live streaming audio and an interactive toolbar that lets you raise your hand or tell the teacher to slow the lesson down.

Contigo Software (619-278-5900, www.contigo.com) also uses

Java with its **Itinerary Web Presenter**, a tool designed to walk users through an HTML-based presentation. Priced at \$199 for unlimited

"passengers," Itinerary lets a "pilot" take control of remote users' Web browsers and guide them through a lesson. Passengers need only a Java-enabled browser to participate. Voice and videoconferencing are expected in future releases.

ILINC (518-283-8799, www.ilinc.com) offers its version of the virtu-

al classroom, **LearnLine I-Net**, at \$48,000 for 100 simultaneous users. Designed to integrate with your existing video- or phone conferencing system, LearnLine I-Net gives instructors the power to guide students to Web content via synchronized Web navigation. Teachers can look at individual student screens to offer help and even yield the floor—along with the courseware control—to a student.

LearnLine I-Net can run courses built using a variety of programs, including Asymetrix's ToolBook II. —David Lidsky



13.3" DISPLAY

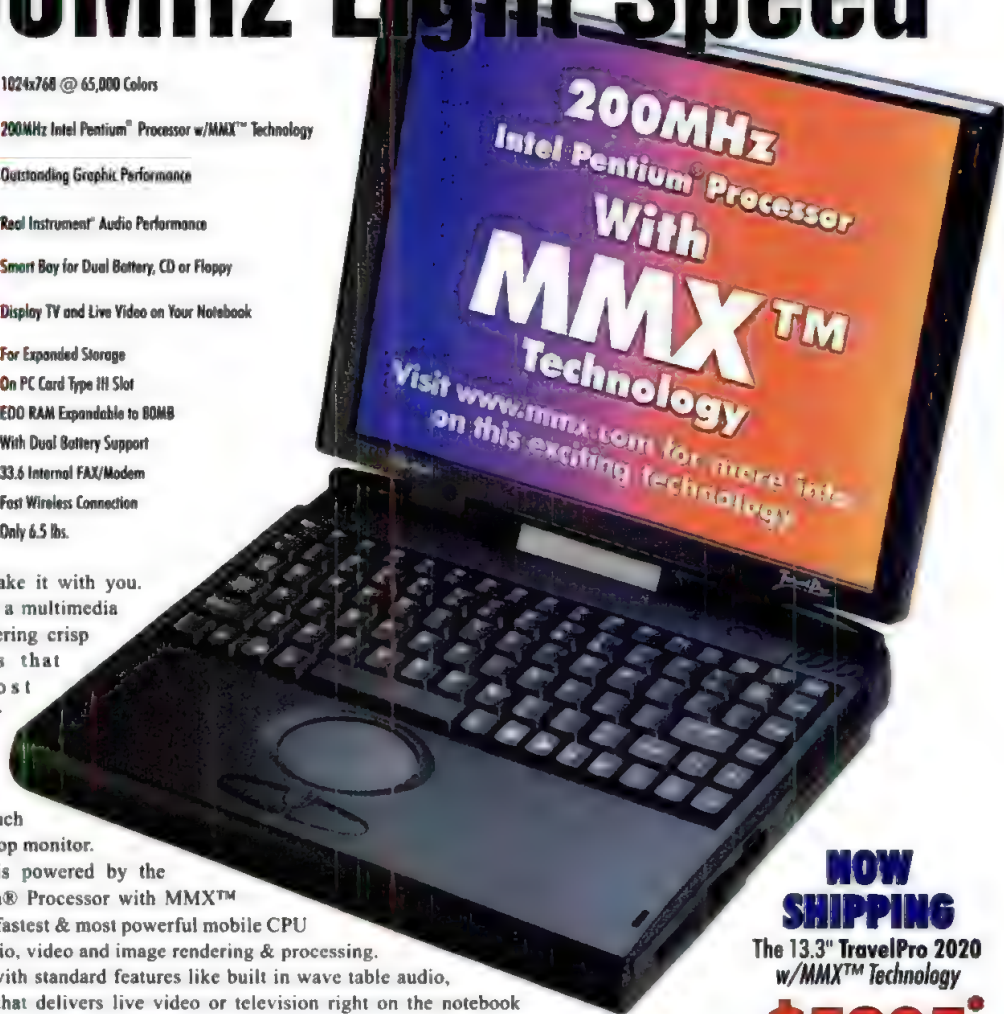
200MHz Light Speed

13.3" DISPLAY	1024x768 @ 65,000 Colors
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2MB Video RAM	Outstanding Graphic Performance
Wave Table Synthesis	"Real Instrument" Audio Performance
10X CD ROM	Smart Bay for Dual Battery, CD or Floppy
Video Capture	Display TV and Live Video on Your Notebook
2.1GB HDD	For Expanded Storage
Zoom Video Support	On PC Card Type III Slot
32MB RAM	EDO RAM Expandable to 80MB
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The TravelPro 2020 is powered by the 200MHz Intel Pentium® Processor with MMX™ Technology, and is the fastest & most powerful mobile CPU available, boosting audio, video and image rendering & processing. The system is loaded with standard features like built in wave table audio, video capture system that delivers live video or television right on the notebook display, 10X CD-ROM, and an internal 33.6 fax/modem. Combine all this with an estimated street price of only \$5,295.00, and you'll see why compared to the TravelPro 2020CX, the rest of the competition just doesn't measure up.



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TRAVEL PRO 2020CX

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SERVER CLUSTERING

Run with Wolves

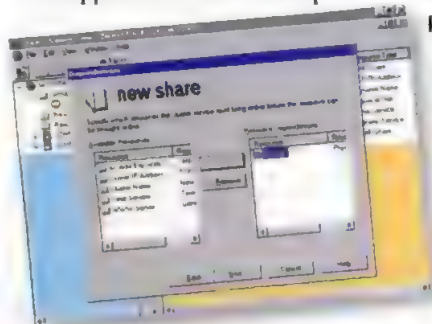
Microsoft Windows NT Server is shedding its image as a fuzzy cub among swift, lean predators. One of the most frequent reasons network planners cite for not deploying Windows NT Server as an application server is its per-

ceived inability to provide reliability and scalable processing power on a par with that of Unix-based systems. Microsoft Corp. (800-426-9400, www.microsoft.com) hopes that its server-clustering software, code-named **Wolfpack**, will convert the skeptics.

To enhance server performance today, Windows NT can use symmetric multiprocessing (SMP), which distributes a server's tasks among multiple processors in a single machine. Server

STRENGTH IN NUMBERS

Microsoft Corp.'s **Wolfpack** aggregates Windows NT Server resources.



NETWORK MANAGEMENT

Extending the RADIUS

Remote Authentication Dial-In User Service, or RADIUS, is a centralized network-authentication standard developed by Livingston Enterprises. The recently ratified RADIUS 2.0 provides a way to centralize all the myriad security and user information normally found scattered across a network. While remote-access servers and firewalls from Ascend, Bay Networks, CheckPoint, Cisco, Raptor, Shiva Corp., and others are compatible with the standard, only recently has RADIUS software become commercially available in something other than shareware versions.

Steel-Belted Radius, from Funk Software (617-497-6339, www.funk.com), is a RADIUS authentication and accounting package that runs under either Windows NT or NetWare. Steel-Belted Radius creates a centralized database of user log-on information, providing extra security, because IS managers don't have to access firewall, operating-system, and hardware configuration software each time a new user is added or modified.

The \$4,000 Steel-Belted Radius

packages for Windows NT and NetWare include preset dictionaries for most popular remote-access servers and firewalls, and support for mixed environments. Administration can be managed from any Windows 3.1, Windows 95, or Windows NT workstation on the network; the one-step Attribute Profile feature lets you group users for quick and easy access control.

Comparably priced at \$4,000 (for a 500-user license), **Shiva Access Manager** provides similar flexibility and interoperability. Known as SAM, this package from Shiva (617-270-8300, www.shiva.com) is a Windows NT-based RADIUS server, but it can also work with Novell's Bindery and Novell Directory Services (NDS) databases.

Like Steel-Belted Radius, SAM provides the three A's of RADIUS 2.0: authentication, authorization, and accounting. Authentication in both Steel-Belted Radius and SAM isn't based on a fixed database; they both provide pass-through authentication to proxy servers, checking them sequentially until authentication occurs.—DRL

clustering extends this concept to multiple servers, providing increased performance and greater reliability if any of the servers fail.

Wolfpack will roll out in two phases. The initial release, expected by midyear, will provide high availability between two servers. Two servers use the same hard disk connected via SCSI adapters; if one server fails, the other can immediately come online to take over tasks. The second release, slated for 1998, will add high scalability,

allowing you to distribute processing tasks among 16 or more servers.

Microsoft says that systems running Wolfpack servers are expected to provide transaction-per-second ratings similar to competing Unix systems but at a much lower cost. Several major PC server vendors have announced plans to support Wolfpack, including Compaq, Digital, Hewlett-Packard, IBM, NCR, and Tandem.—Todd Spangler

ELECTRONIC WHITEBOARDS

Just Touch...and Go

A new crop of networked electronic whiteboards is allowing educators and pitchmen to send their messages across the room and across the country. Each of these products allows you to link electronic whiteboards for truly interactive presentations.

The \$499 **Ibid**, from Micro-Touch Systems (888-388-4243, www.microtouch.com), has a 2- by 3-foot writing surface that connects to your PC via a serial port. During a session, such controls as pen color are directed right from the board, freeing you from having to operate a PC at the same time. The included Snapshot file system allows you to capture screen shots for future reference and export them as bitmaps (.BMPs) or Windows Metafiles (.MTFs). The only external requirement is an Internet conferencing package, such as Microsoft NetMeeting or Netscape's new Communicator.

Smart Technologies (888-427-6278, www.smarttech.com) offers the **Smart Board**, a family of electronic whiteboards ranging from a \$1,199 model the size of the Ibid to a 5- by 4-foot version for \$2,999. Like the Ibid, the Smart Board works with popular conferencing software and plugs directly into your PC's serial port, so you can mark up presentations with regular dry-erase markers.

Unlike the Ibid and the Smart Board, the **SoftBoard**, from SoftBoard (888-763-8262; www.softboard.com), uses lasers and bar-coded pens to provide interactivity. The board itself is made of porcelain mounted on steel, which provides higher durability and easier cleanup than the softer MicroTouch and Smart



whiteboards. Like the Smart Board, the SoftBoard is available in several sizes, but the more advanced technology commands a higher price; the Model 423, which has a 58.5-inch image surface, has a list price of \$27,500.—David R. Lambert

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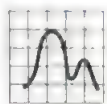
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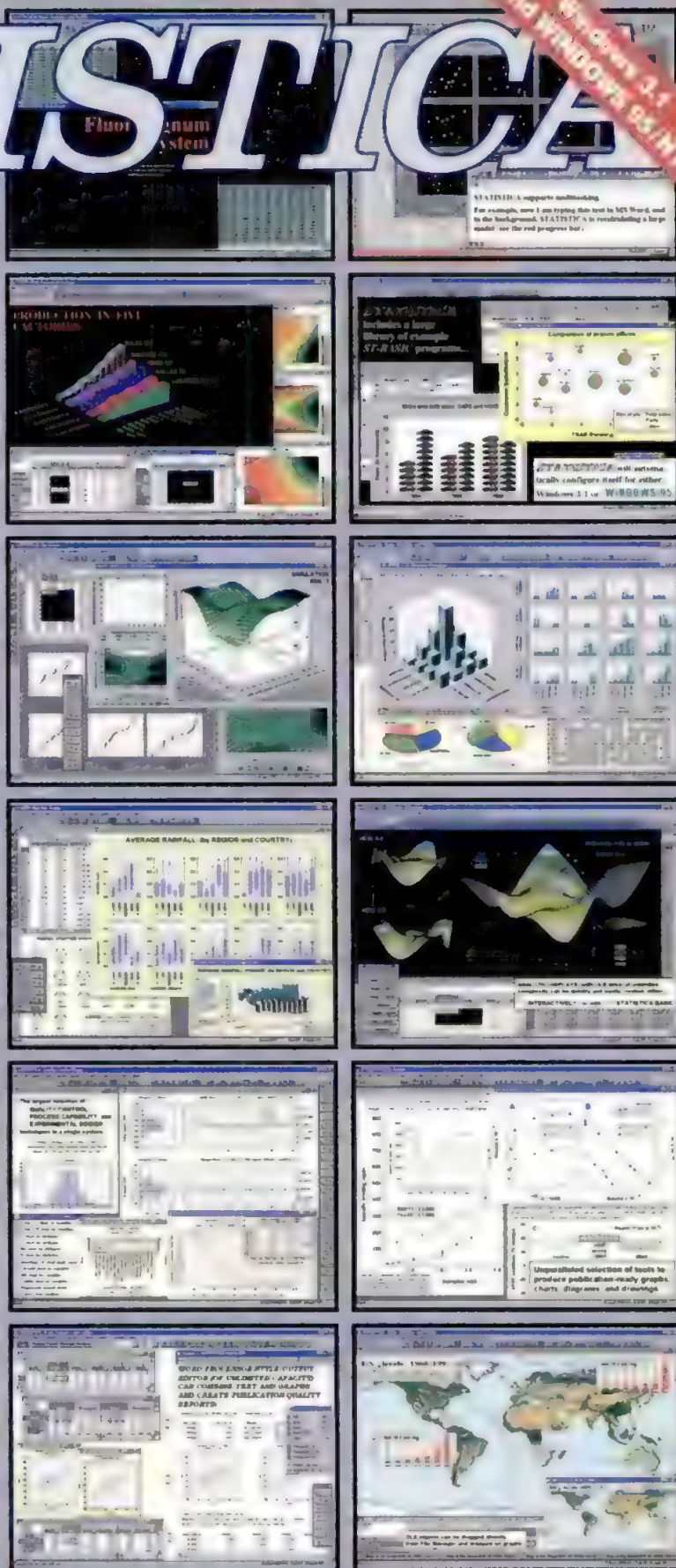
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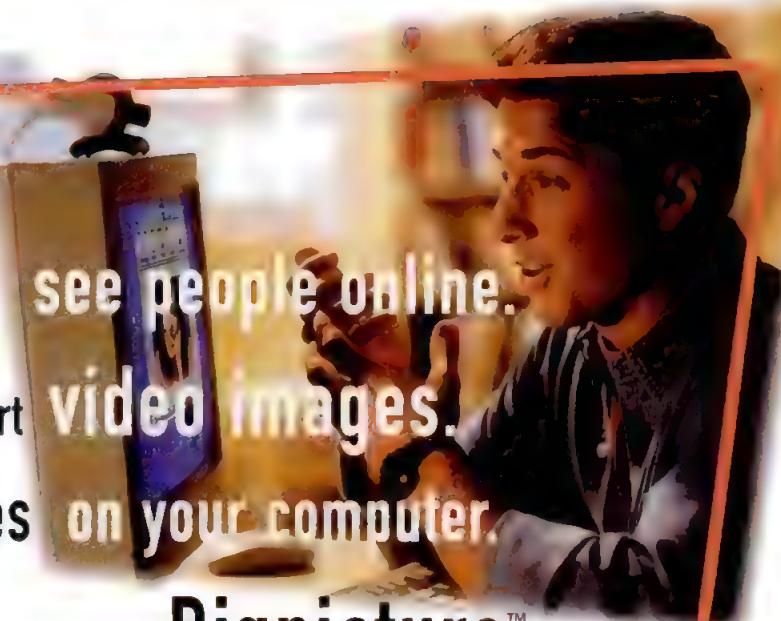
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First Looks

In-Your-Face Browsing

Fourth-generation browsers from Microsoft and Netscape bring the Web closer to your desktop.—By John Clyman, Edward Mendelson, and Brian Nadel

Which is more important, the operating system or the Web browser? If the latest free, downloadable previews of what's in store for Web browsing from Microsoft and Netscape are any indication, the answer is both.

Starting at roughly the same point but heading in opposite directions, Microsoft Inter-

viewed in Prelease 2 form, has an integration plan of its own.

In a technically ambitious move, Microsoft blurs the line between the Web and your PC. Although incomplete at this point, the company's Active Desktop technology essentially creates a container for viewing ActiveX

scape to catch up in this regard with the release later this year of Constellation, in which Navigator will start to take on the role of an OS shell.

Navigator is now a legitimate groupware program with enhanced mail and news features. The program has a much improved interface, which is sleek, functional, and efficient. IE 3.0 took the lead with its interface, but Version 4.0 of Navigator fully catches up with IE 4.0.

Both IE and Navigator perform the tasks of basic browsing well. They support HTML 3.2 specifications, Cascading Style Sheets, and dynamic style sheets, but that's just the start.

These browsers are part of communications and collaboration suites with conferencing, e-mail, and news capabilities built-in. Both programs narrow the gap between your desktop and the rest of world by tapping into remote LDAP address-book databases—such as Bigfoot and Four11—as easily as they use personal address books. And because they both work with the IMAP4 protocol, you can keep your e-mail on the server and download only the headers or the first few hundred bytes of individual messages.

Although it's only a small part of the story, we tested to see what level of Java performance you can expect from these browsers. On most of our tests, Navigator was the more improved of the two browsers over their respective predecessors, but it still lags behind IE.

In terms of features and abilities, the two programs are com-

controls, HTML objects, Java applets and other live content. IE lets you choose to do away with individual application windows altogether, leaving a wide-open desktop display in which Windows Explorer becomes just another browser view, albeit one with a very specialized role. In case you don't want this level of integration, IE can act simply as your Web browser. Expect Net-

net Explorer 4.0 and Netscape Navigator 4.0—and Communicator, the suite that surrounds it—attempt in vastly different ways to be the center of your computing attention. As seen in the Platform Preview we looked at, IE is well on its way to working more closely with Windows; Communicator, which we re-

INSIDE

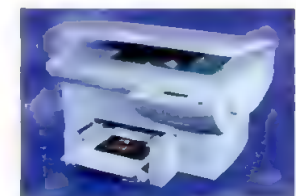
ALL ABOARD:

U.S. Robotics lights up the PDA market with the Palm Pilot Pro. See page 54.



ON THE ROAD:

With Phone Disc's PowerFinder Pro, you can travel with knowledge. See page 70.



THREE-FOLD PRO:

The HP OfficeJet Pro 1150C allows you to copy, scan, and print—in living color. See page 58 for a full review.

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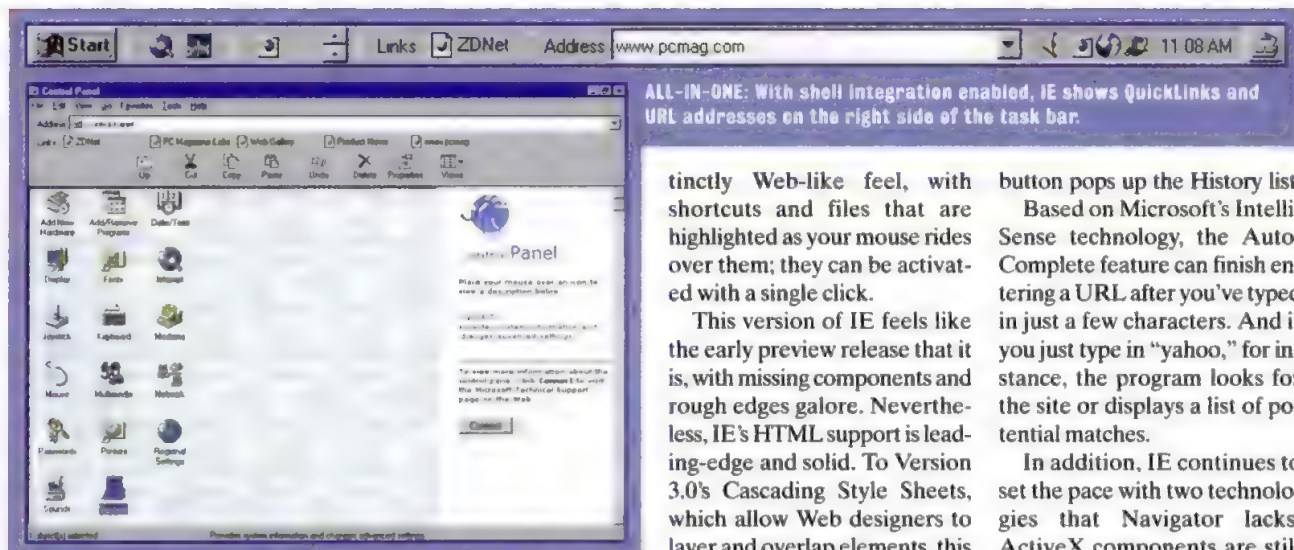
First Looks Online

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First Looks



Microsoft Internet Explorer 4.0

List price: Free

Requires: 16MB RAM, 30MB hard disk space; Microsoft Windows 95 or Windows NT 4.0

Redmond, WA
800 485 3900
www.microsoft.com/ie/

parable, although they take different approaches. For example, when it comes to revisiting sites, Microsoft continues to use its Favorites list and Netscape sticks to its Bookmarks. But each allows you to use drag-and-drop to organize the list and make additions to it.

Bear in mind that these browser suites are works in progress, and IE is the younger, more fragile, and less complete of the two. Regardless of which one of the two you choose—if choose you must—these Web browsers offer a tantalizing glimpse at the Web-centric future of the world of computing.

Microsoft Corp.

Microsoft Internet Explorer 4.0

With the Platform Preview of Internet Explorer 4.0, Microsoft has taken the first serious strides toward its goal of

making the Web browser just another part of the operating environment. Whether you find this integration appealing, you'll discover that IE 4.0 is a truly superb Web browser suite.

The borrower's most remarkable—and undoubtedly most controversial—elements are its shell integration and Active Desktop technology. With shell integration enabled, the dividing line between the operating system and the Web browser largely dissolves. You can place HTML pages on your desktop, which in an era of push content, such as Java and ActiveX stock tickers, puts the pages front and center.

You can drag application shortcuts right onto the Windows taskbar and open a URL address field there too; enter a Web address and the page pops up in your browser. Best of all, with a single mouse click, you can toggle to a mode that makes your application window disappear, leaving a wide-open desktop.

In fact, Microsoft's goal was nothing short of subsuming Windows Explorer into a specialized view from within IE. The result is a unified HTML-style interface for accessing both local content and the Web. The desktop gains a dis-

tinctly Web-like feel, with shortcuts and files that are highlighted as your mouse rides over them; they can be activated with a single click.

This version of IE feels like the early preview release that it is, with missing components and rough edges galore. Nevertheless, IE's HTML support is leading-edge and solid. To Version 3.0's Cascading Style Sheets, which allow Web designers to layer and overlap elements, this version adds support for absolute positioning and z-ordering. Web pages can be made more interactive, because text and styles can now be controlled dynamically from within the HTML page. Clicking on a button, for instance, can cause a context-sensitive menu to appear—without a trip back to the server to retrieve data. And text can now be neatly wrapped around irregularly shaped graphics.

While its basic interface is relatively unchanged, IE abounds with minor revisions: You can now reorganize your Favorites by dragging and dropping them—just as in Navigator—and right-clicking on the Back or Forward

button pops up the History list.

Based on Microsoft's IntelliSense technology, the Auto-Complete feature can finish entering a URL after you've typed in just a few characters. And if you just type in "yahoo," for instance, the program looks for the site or displays a list of potential matches.

In addition, IE continues to set the pace with two technologies that Navigator lacks: ActiveX components are still available in Navigator but only with third-party programs, and Navigator does not support PICS, the content-rating framework, that keeps prying eyes away from objectionable material.

In IE, the Web-search interface can be present at all times, which cuts down on the next-page/last-page shuffle when sifting through search hits. IE divides the page into a left-hand frame that contains the links returned by a search engine and a right-hand frame that displays the individual sites as you click on the links.

With IE's subscriptions facility, you can set the browser to download your favorite pages

Web Browsers: Side by Side

	✓ YES ✗ NO	Microsoft Internet Explorer 4.0	Netscape Communicator
Keyboard-only interface	✓	✓	✓
Cascading style sheets	✓	✓	✓
Dynamic style sheets	✓	✓	✓
Absolute positioning	✓	✓	✓
Bookmarks	✗	✓	✓
Favorites	✓	✓	✗
Kiosk mode	✗	✓	✓
HTML-formatted mail	✓	✓	✓
LDAP directory access	✓	✓	✓
IMAP mail	✓	✓	✓
HTML editing	✓	✓	✓
Discussion groups	✓	✓	✓
Whiteboard conferencing	✓	✓	✓
Voice conferencing	✓	✓	✓

automatically, which facilitates off-line browsing. You can schedule IE to check for site updates and indicate how many links deep it should delve. When a page changes, a small red glow appears in the corner of the page's Bookmark icon; IE can even create an e-mail message to alert you that a page has been updated.

At heart, IE is an Internet communications center. Its Outlook Express (OE) is somewhere between a lightweight version of Office 97's personal information organizer, Outlook, and an enhancement to IE 3.0's Internet Mail and News modules. OE is an HTML-aware mail and news client, which provides a centralized address book with LDAP support. The address book lets you keep contact information complete with e-mail addresses in one place, and the program can automatically add entries to your address book when you reply to a message.

Mail and news support, accessible from a button on the browser toolbar, is provided in OE. Like Navigator, IE provides IMAP4 messaging. Mail-filtering capabilities are extensive, so you can route messages, but we were disappointed that this feature didn't support multipart filters using Boolean logic.

OE can read and compose HTML mail, but with more complex page composition FrontPad takes over. Compared with the editor in FrontPage, FrontPad is feature-limited, but for authoring and editing Web pages, it lets you edit HTML in a near-WYSIWYG environment. Unfortunately, FrontPad doesn't support dynamic HTML capabilities, frames, or style-sheets, but it was more than capable for basic intranet publishing. Microsoft plans to bundle its Personal Web Server with IE to facilitate publishing to an intranet.

For voice- and videoconferencing, Microsoft includes the

NetMeeting client. NetMeeting provides not just a shared whiteboard but true application-sharing capabilities as well.

As a whole—even without the Windows integration—IE matches or slightly exceeds the capabilities of Netscape Communicator. On its own or as your computing center, the core elements in IE are technically strong and point the way to a world with the Web at its center.

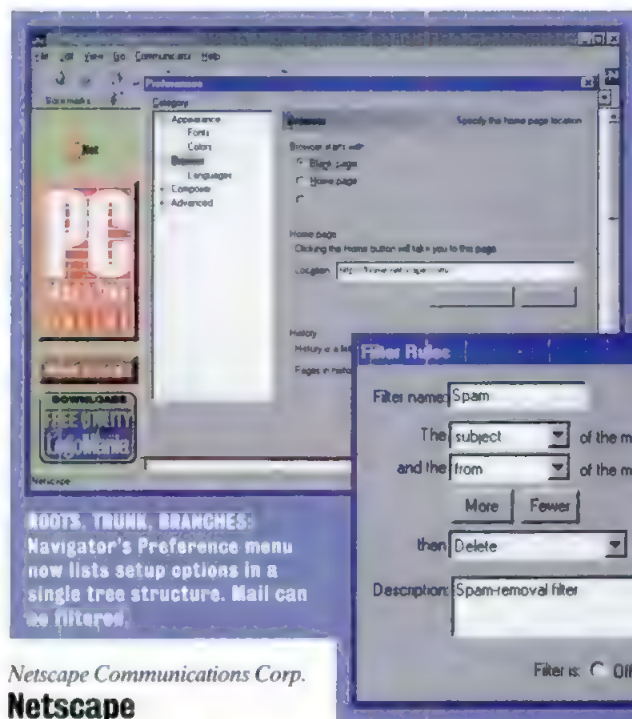
protocols not proprietary formats and transport mechanisms.

Further down the road of desktop integration, Netscape's Constellation—expected in the coming months—will bring the OS and browser together, with an emphasis on the browser. Unlike in IE, Constellation's browser rules, so a push application can take over the desktop and turn it into a front end for searching and receiving data.

According to Netscape, the next beta version of Navigator will have support for Microsoft OpenType, which allows the placement of highly compressed fonts on pages, and Bitstream's TrueDoc. In the meantime, Microsoft is working with Adobe to implement OpenType for IE. There's even a full-screen kiosk option—which will likely be accessible from a menu in the shipping version—but it is available only with a command-line switch in this beta version.

A toolbar that can float gives one-click access to the four main components: browser, mail, news, and HTML editor. The browser window shows the most obvious changes from Navigator 3.01, with more attractive main toolbar buttons and drop-down lists.

Frequently visited sites show



Netscape Communications Corp.

Netscape Communicator

Netscape Communications hastens the day when your Web browser becomes your most important window on the world. Communicator, which will be priced at \$59, contains Netscape Navigator 4.0 as well as modules for e-mail, traditional Internet news, and up-to-date collaboration and conferencing, and an HTML editor for creating and uploading Web pages.

With all its components, Communicator is much more than a basic browser. It is a rival for such groupware applications as Lotus Notes and Microsoft Exchange, but Communicator is based on standard Internet pro-

Navigator has shed its dowdy interface for sleek, customizable toolbars designed to minimize wasted space and maximize access to essential features. The second Prerelease version we evaluated lacked features promised for the final release in the spring, but this preliminary version is comparable in features and performance with the beta version of IE 4.0

Customizable multiple-user profiles let you choose between news and mail servers when you start the program. In day-to-day use, however, using the profiles is awkward, because you have to choose among them every time you start the program, and you can't specify a default setting.

Netscape Communicator
List price: \$59
Requires: 16MB RAM, 13MB hard disk space, Microsoft Windows 3.1, Windows 95 or Windows NT, or Macintosh System 7.1, or Unix

up with a right-click option of the Forward or Back buttons. You can now create Bookmarks by dragging the icon of the current page into any position in the Bookmark list, including into subfolders. Alternatively, you can drag the icon to a new personal toolbar that takes the place of the

First Looks

PERFORMANCE TESTS

Fourth-Generation Web Browsers



Microsoft Internet Explorer 4.0 and Netscape Communicator performed about the same or better than their predecessors running Java applets.

In overall performance, Internet Explorer 4.0 edged out Communicator.

We tested these Web browsers with JMark 1.01 on a Pentium/133 PC with 16MB of RAM, running at 800-by-600 resolution in 24-bit color mode. For complete test descriptions, see "Java Tools Get Real" in our issue of January 7, 1997.

	AWT Graphics Mix	AWT Bits/Images	Stack	Bubble Sort
MS Internet Explorer 4.0	2,154	744	1,036	1,023
Communicator	2,076	7,460	1,387	1,675
MS Internet Explorer 3.0*	2,169	582	1,611	3,060
Navigator 3.01*	1,722	578	1,301	1,045

* Reported for comparison

Gold as the program's HTML editor. It's a straightforward tool that shows pages in near-WYSIWYG format. A step ahead of FrontPad, Composer is great for creating simple Web pages or editing existing pages, but it won't work with frames or HTML forms. It has a spell-checker and a useful tool for resizing graphics, and it supports a plug-in architecture that adds Netscape or third-parties tools to perform these and any other editing tasks.

Communicator has one decided advantage over IE: support for 14 operating systems, with more in store. Microsoft is working on versions of IE 4.0 for Windows 95 and Windows NT. There will eventually be versions for Windows 3.1, Macintosh, and Unix systems, but they will no doubt have varying levels of operating-system integration.

Communicator's \$79 Professional Version will include a scheduling module, telnet access to IBM 3270 systems, and an automated administrative kit for configuring Communicator clients over a network. Many of these capabilities are available via IE's administration kit.

Despite some rough edges, Communicator feels flexible, responsive, and fast. It doesn't take over your desktop, as IE wants to do, but it acts as a portal for a huge variety of data. □

space-wasting Directory Button.

The overgrown options menus have been rearranged into a compact, logical structure, with all preferences set from a single tree-structured list. As in IE, you can work through links from the keyboard, and enhanced hot keys include one-keystroke display of the current page's HTML code. Descriptions of images appear as ToolTips when the mouse passes over the images.

Support for the automatic installation of Plug-ins, which will likely match the transparent installation of IE's ActiveX controls, is expected in the final product. Although not optimized for memory usage, the beta version of Navigator that we looked at was notably more stable than

earlier shipping and beta versions, and it preserves Windows resources more reliably.

Navigator will provide for absolute positioning of text and graphics, and HTML layers in the shipping version will match those of IE—though the two browsers use different tags to achieve the same result. Web designers will be able to control graphic design precisely and manipulate layers via JavaScript. Navigator now adheres more closely to the HTML 3.2 standard than earlier versions did. Some pages display with slightly different layouts than before, so expect some minor glitches.

Netscape Mail and News are now combined into Netscape Messenger, which retains the

convenience of the earlier version but adds powerful new features. Messages and news postings display optionally in a viewer pane below the list of headers, with images displayed in line and support for HTML-formatted text. As a bonus, you can use extensive filing rules to store messages—or delete them—in specific mailboxes automatically when the text or headers match specified text strings. The News interface lets you set up multiple servers and switch among them with a mouse click.

The Conferencing module updates Netscape's aging CoolTalk application by adding a speakerphone module, speed-dialing, and a long-overdue setup wizard.

Composer replaces Navigator

NCSA Mosaic 3.0: The Return of the Original

NCSA Mosaic, the original graphics-based Web browser, has roared back with an innovative 32-bit version. Mosaic 3.0, like its 16-bit predecessors, is the work of the National Center for Supercomputing Applications at the University of Illinois. It's still free, and it's still buggy, but it performs feats that Internet Explorer and Navigator haven't even thought of.

AutoSurf is a feature that saves a whole Web site to your disk for off-line browsing, and SiteMap builds a page that lists all the links on a remote site. Mosaic has a built-in editor that lets you compose but not receive e-mail and a bare-bones newsgroup reader, which doesn't support servers that require passwords.

Mosaic's main screen is divided into a standard browser pane and a multipurpose pane, which displays different data as you click on a row of tabs. One tab brings up a list of sites

visited in the current session or those from an earlier session that you saved to disk and then reloaded. Another tab brings up a tree-structured display of all sites recently visited, and yet another lists the contents of cache. There are tabs that list newsgroups, display the source code of the current page with an option to edit it, and provide a tree-structured help menu.

Unfortunately, Mosaic's support for recent HTML extensions is so incomplete that many Web pages display with obviously jumbled layouts—sometimes with text to the right of the separator lines, sometimes with text not displayed at all. Animated .GIF images display as static images—and don't even think about viewing frames or Java applets. Mosaic lags behind Navigator and IE in speed as well. You can download the 3MB Mosaic file from www.ncsa.uiuc.edu/SDG/Software/Win.Mosaic/HomePage.html.—EM

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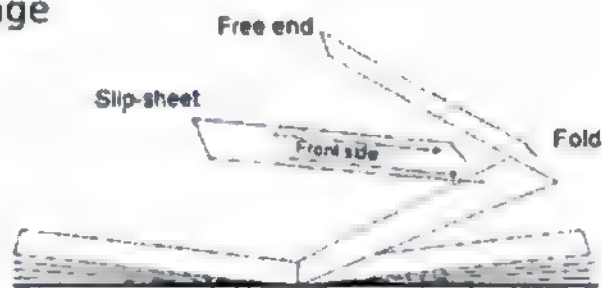


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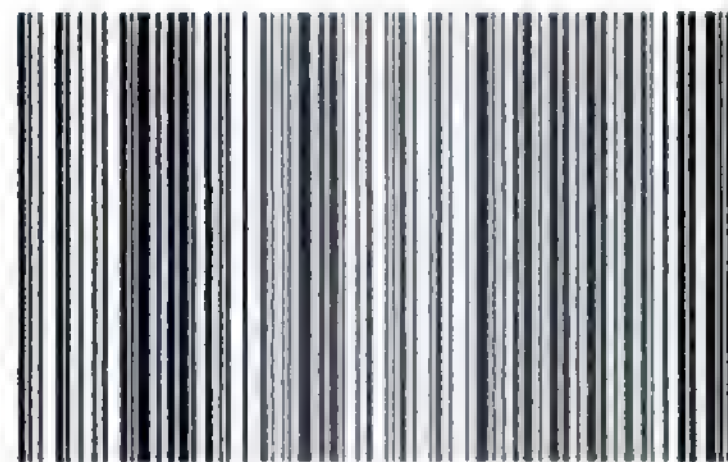
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1. Open the foldout page
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 1. Front side touching the free page
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3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



Inverted Foldout slip-sheet

Folded edge of the page

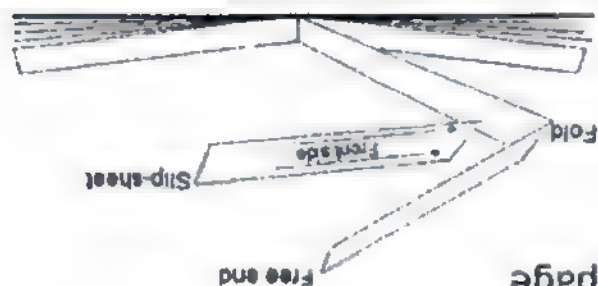
1. Open the foldout page
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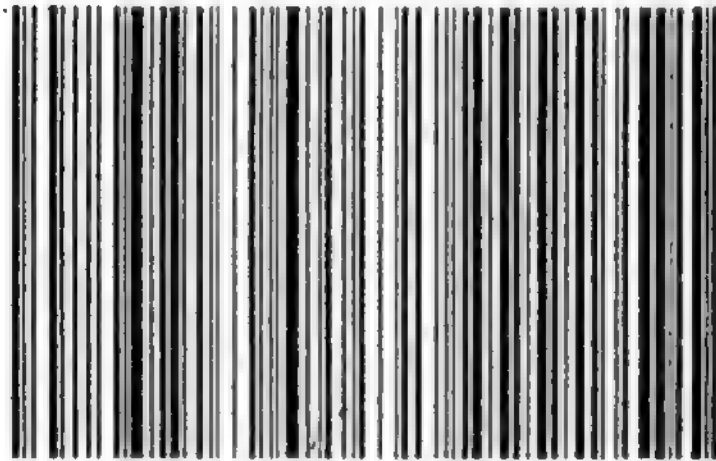
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1. Follow instructions on the other side

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GbsSlipBack-001B

Back

1. Follow instructions on the other side

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He forges a path through the raging blizzard. Waiting in the post office is a Gateway Solo™ 2200 portable PC, a force more powerful than the winter storm outside. Next to it is a high-performance G6-200 Pentium® Pro processor-based professional PC. Both systems can be custom configured and are loaded with lots of great features. Microsoft® Office 97 Small Business Edition plus Encarta® 97 software is tailored to the needs of home and office. Keeping the post office organized was not only going to be easy, it was going to be fun. The keykeeper could play post office all day, but duty calls.



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- Altec Lansing ACS-41 Speakers
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- 16-Bit Ensoniq Wavetable Sound Card
- Altec ACS-410 & ACS-251 Speakers
- TelePath 33.6 Data/14.4 Fax Modem for Windows with Speakerphone
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- Altec ACS-410 & ACS-251 Speakers
- TelePath 33.6 Data/14.4 Fax Modem for Windows with Speakerphone
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Performance Graph



Ziff-Davis' Winstone 97 Version 1.0 produced scores of 16.9 and 36.4; 18.2 and 38.0; and 20.2 and 42.7 Winstone Version 1.0 units on its High-End Winstone 97 suite and Business Winstone 97 suite on Gateway 2000, Inc. PCs configured with 166MHz Intel Pentium Processor with MMX technology, 200MHz Intel Pentium Processor with MMX technology, and 200MHz Intel Pentium Pro processor, respectively. All Gateway 2000 PCs tested featured 32MB RAM, 256K RAM cache, 3.8GB hard disk, IDE controller, FAT file system, and no hardware disk cache. Systems include S3 ViRGE/VX graphics adapter; with 4MB VRAM with v1.23m3 driver; 1024x768 with 256 colors; and a refresh rate of 75Hz. Test systems used MS DOS 7.1 and MS Windows 95. All products used in the test were shipping versions available to the general public, and the test and its results were not verified by Ziff Davis.

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Professional Systems

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- Intel 133MHz Pentium Processor
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- 256K Pipelined Burst Cache
- CrystalScan500 .28dp Monitor (13.9" viewable area)
- 2MB SGRAM, 3-D 64-Bit PCI Graphics
- 1.2GB 11ms EIDE Hard Drive
- 12X CD-ROM/3.5" Diskette Drives
- Mini Tower Case
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P5-166

- Intel 166MHz Pentium Processor
- 24MB Synchronous DRAM
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- 2MB SGRAM, 3-D 64-Bit PCI Graphics
- 2.5GB 11ms EIDE Hard Drive
- 12X CD-ROM/3.5" Diskette Drives
- Mini Tower Case
- 104+ Keyboard & MS IntelliMouse
- MS Windows 95
- MS Office 97, Small Business Edition*
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- Intel 200MHz Pentium Processor with MMX Technology
- 32MB Synchronous DRAM
- 512K Pipelined Burst Cache
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- 2MB SGRAM, 3-D 64-Bit PCI Graphics
- 2.5GB 11ms EIDE Hard Drive
- 12X min/16X max CD-ROM/3.5" Diskette Drives
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- 104+ Keyboard & MS IntelliMouse
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- 256K Internal Cache
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The Dakota Keykeeper —
Gateway 2000 Security Guard,
Ed Redenius, shown here on
the screen of a desktop PC.





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*All x2 products are capable of 56 Kbps downloads; however, due to FCC rules which restrict power output, current download speeds are limited to 53 Kbps.

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First Looks

PCs

The \$1,000 PC—Sort Of

The Compaq Presario 2100 breaks the \$1,000 barrier, but at the cost of performance.—By Robert S. Anthony

If you're the type who fingers the coin slot after using a pay phone, Compaq Computer Corp. is looking to sell you a \$1,000 Compaq Presario 2100. Be prepared to settle for less than stellar performance, though, and your total cost may exceed \$1,000, because the package doesn't include a monitor.

The charcoal-black Presario 2100 is clearly aimed at frugal home users shopping for their first computers and bargain-hunting second-time buyers. The key to the Presario 2100's low price is the Cyrix Media GX chip set, which costs OEM vendors as little as \$99; by comparison, a midrange Pentium CPU costs several times that amount. The two-chip Media GX system incorporates most key processing, graphics, and I/O functions, making the Presario 2100 the model of modern PC integration.

The Media GX processor chip is x86-compatible, runs at 133 MHz, has 16K of internal cache, and includes a 64-bit graphics accelerator. There are also controllers for system memory and the PCI bus, which run at the processor's clock speed. The com-

panion Media GX Cx5510 chip includes the audio controller, PCI-to-ISA-bridge circuit, IDE controllers, and power management functions.

Proprietary software is the glue that holds the system together. Cyrix's Virtual System Architecture (VSA) replaces such typical hardware devices as graphics and sound cards. These instructions are implemented via three trademarked technologies—XpressRAM (direct memory access), XpressAudio (Sound Blaster-compatible sound), and XpressGraphics (graphics acceleration).

Because you apportion part of the system's EDO memory for graphics, there's no dedicated graphics memory. And of the system's standard 24MB of RAM, up to 2.13MB can be allocated for video memory. In addition, the Presario 2100 includes a 2.1GB hard disk and an 8X CD-ROM drive. Two speakers, two volume-control buttons, and a

sleep-mode button are built into the VCR-size case.

Cyrix claims that the 133-MHz Media GX CPU is the equivalent of a Pentium/133 processor. The good news is that we found no software incompatibilities between the Media GX and major applications. The bad news: Our tests show that across the board the Presario 2100's benchmark

average Pentium/200 machine ("Choose Your 200," December 3, 1996). And the Presario 2100 had 20MB of available system memory; each Pentium/200 system on our test group systems had only 16MB.

There are, however, two redeeming factors. The Presario 2100's CD-ROM WinMark 97 score of 699 placed it just behind the ranks of today's Pentium PCs. And the system's PremierSound Audio System was first-rate. By building the speakers into the system's box, Compaq makes it possible for the Presario 2100 to port the bass portion of the audio spectrum from the rear of the unit.

Other than to upgrade system memory, there's no reason to open the Presario 2100's case: There are no open expansion slots or drive bays. A 33.6-Kbps fax modem occupies the lone proprietary slot on the motherboard. In addition to standard I/O ports, the

motherboard offers microphone and headphone jacks, and a joystick/MIDI port. A nice touch is the addition of mistake-proof phone jacks: It doesn't matter which jack is connected to the wall and which to the phone.

Though relatively complete at \$1,000, the Presario 2100 lacks a monitor. Compaq offers its \$300 14-inch monitor, the Presario V400, to compliment the Presario 2100. By contrast, Packard Bell's \$1,000 C115 includes a monitor—albeit a relatively coarse one—and a Pentium/120 processor.

The Compaq Presario 2100 may fit into your budget, but the system's performance may try your patience.

Compaq Presario 2100. List price: With Cyrix Media GX CPU, 24MB RAM, 2.1GB hard disk, 8X CD-ROM, \$1,000. Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; www.compaq.com.



GRAND DEAL: The Compaq Presario 2100 sells for less than \$1,000, but it doesn't include a monitor.

test scores were more in line with those of a low-end Pentium PC.

Our test unit yielded scores of 20 and 20.5 on our Business Winstone 97 and Business Graphics WinMark 97 benchmark tests, respectively. This places the Presario 2100 well behind the

BENCHMARK TESTS

Compaq Presario 2100



The Compaq Presario 2100, which is based on the 133-MHz Cyrix Media GX processor, had trouble keeping up with more mainstream desktop PCs. Its Business Winstone 97, Business Graphics WinMark 97, and CPUmark₃₂ benchmark test scores were in line with those of a low-end Pentium PC.

To gauge the performance potential of the Presario 2100, we used our test suites ZD Winstone 97, Version 1.0, and ZD WinBench, Version 1.1. The Presario 2100 was equipped with 24MB of RAM, of which 2.13MB was devoted to graphics. The systems we used for comparison each had 16MB of RAM.

	ZD Business Winstone 97 Score	ZD Business Graphics WinMark 97 Score	ZD Business Disk WinMark 97 Thousands of bytes/sec	ZD CPUmark ₃₂ Score	ZD CD-ROM WinMark Thousands of bytes/sec
Compaq Presario 2100	20	20.5	464	168	699
Average P/200 desktop PC ("Choose Your 200," 12/3/96)	54	84.7	788	551	828

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First Looks

ORGANIZERS

Pilot Turns Pro

By adding a backlit screen, memory, and some other goodies, the Palm Pilot Pro packs more power.—By Cade Metz

Having carved out a niche in the organizer market, U.S. Robotics' Palm Pilot (First Looks, May 14, 1996) moves upscale with its \$399 Palm Pilot, Professional Edition. While retaining its sleek profile, the Pilot Pro falls somewhere between the simplicity of Sharp's Wizard and the complexity of Microsoft Windows CE machines.

The Pilot Pro is just as small, light, and pocketable as the Pilot 5000. But the Pilot Pro adds a backlit screen, so you can view the 160- by 160-pixel LCD in a darkened restaurant just as easily as in bright sunlight. The system still runs for 8 to 12 weeks on a pair of AAA batteries.

The Pilot Pro contains a full megabyte of memory—twice that of the Pilot 5000—which is enough for 4,000 addresses, 2,400 appointments, 750 to-do items,

750 memos, and 100 pieces of e-mail. There's also a \$299 Palm Pilot, Personal Edition, which includes 512K of RAM.

The Pilot's operating system, which has spawned myriad third-party applications, allows for brisk and convenient record keeping from a pocket-size device, and it makes the most of the power of your desktop PC. In addition to the unit's built-in expense-tracking and e-mail software, the Pilot Pro supports data transfers to and from popular PIM applications, including Symantec's ACT!, Lotus Organizer, Microsoft Outlook, Microsoft Schedule+, and Starfish Software's Sidekick.

The Pilot Pro is no larger than a deck of playing cards (4.7 by 3.2 by 0.7 inches), and it weighs a mere 5.7 ounces. Like its predecessors, it includes a date book,

address book, to-do list, memo pad, calculator, and global Find feature. Using the unit's stylus, you can input data with either an on-screen keyboard or an on-screen writing pad.

The Pilot Pro's desktop software lets you enter PIM records in your Windows or Macintosh system and then automatically transfer those records to your hand-held unit—or vice versa. These Hot-

Sync transfers used to require a docking cradle that connected to your PC's serial port, but there are now two new options: a \$129 snap-on modem and a \$69 Network HotSync option kit that synchronizes over your LAN.

The HotSync feature can now be used to record business-trip expenses as they occur and then transfer the information to your desktop PC when you return to the office. Using Microsoft Excel, the desktop software then totals

your spending and creates a detailed report; report templates are provided.

The Pilot Pro also offers a portable extension of your desktop e-mail client (that is, if you use Lotus cc:Mail, Microsoft Exchange, Microsoft Mail, or a major MAPI, VIM, or POP3 Internet client). You can read, delete,

compose, and organize messages on your hand-held unit and then easily transfer any changes to your desktop.

By putting your whole world in your hand, the Palm Pilot, Professional Edition, makes a good thing even better.

Palm Pilot, Professional Edition. List price: \$399. U.S. Robotics Inc., Mountain View, CA; 800-881-7256; fax, 800-437-3299; www.usr.com/palm. Circle 409 on reader service card



TAKE OFF:

The Palm Pilot, Professional Edition's improved memory, screen, and HotSync capabilities make it a must-have.

Pilot Soars with New Apps

Amid dozens of add-ons for the Pilot, we unearthed three terrific little programs: a financial calculator, an e-mail package, and a spreadsheet.

LandWare's **Financial Consultant** (201-261-7944, www.landware.com) is a \$39 financial calculator that does it all: time and money calculations, depreciation computation, investment analysis, percentage calculations, and scientific functions. The 32K program has ten storage registers and five finance memories. You can also copy and paste computations into other applications. Financial Consultant is an ideal tool for business professionals who are experienced with whiz-bang calculators.

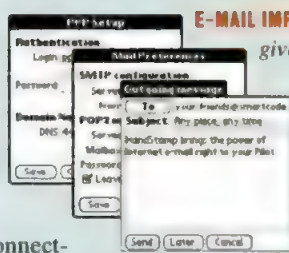
HandStamp (847-945-3516, www.smartcodesoft.com), from Smartcode Software, is a \$50 e-mail add-on that sports an

integrated PPP TCP/IP stack, allowing you to send and receive Internet mail through virtually any ISP. HandStamp supports standard mail protocols—POP3, PPP, and SMTP—as well as several security protocols (APOP, CHAP, and PAP).

We tested the program by connecting a Pilot 5000 to a Zoom 14.4-Kbps external modem with U.S. Robotics' Pilot Modem Cable. After specifying a Domain Name Service, mail host, and passwords, we easily connected to an AT&T WorldNet account. Within seconds, our queue of outgoing mail was on its way, and our incoming messages were available for off-line perusal. Unfortunately, HandStamp balks at saving any messages larger than 8K.



TALLYHO: Financial Consultant is as functional as a financial calculator.



E-MAIL IMPRESSION: HandStamp gives your Pilot a powerful postal presence.

If you've mastered Graffiti and need a spreadsheet for the road, look to Cutting Edge Software's \$50

QuickSheet 1.0 (972-378-1300, www.cesinc.com): This 57K program provides a robust array of functions, allowing you to create as many as 15 sheets in each workbook. Available memory is the only limitation to the number of cells.

At press time, Cutting Edge was readying Version 1.5, which includes row and column locking, support for foreign currencies, and compatibility with Microsoft Excel. The Pilot may not be the best environment for working with spreadsheets; nonetheless, QuickSheet gives you all the tools.—By Rick Broida

**Mike
Latschislaw
finally found
a monitor
as good as
the games
he designs.**

Over at the JVC games division they look to Mike Latschislaw to make their games come alive. But while he's doing it, Mike looks to something else. The new 17PX monitor from Hansol.

Because according to Mike, no other monitor sets up as easily, has as many controls (20 on-screen settings), is as practical to use, and with its radical, modern design, is just such a pleasure to look at.

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Because when it comes to monitors, Mike doesn't play games.



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First Looks

PERIPHERALS

The Office Trifecta

HP's color OfficeJet Pro 1150C combines the best of three worlds in a multifunction machine.—By Alfred Poor

Pick up a photograph and try this: Place it on a scanner bed, make a copy of it, scan the image into your computer, and print the scanned image—all with the same machine. Wishful thinking? Well, Hewlett Packard Co.'s \$1,000 HP OfficeJet Pro 1150C performs all these tasks, which makes it a desktop imaging center.

The OfficeJet Pro is designed to have everything you need to equip a small office for imaging work. It works as a walk-up photocopier; the front-panel controls and 16-character LCD message window make it easy to adjust darkness, zoom in and out, select paper type, and choose between color and black-and-white copies. There is even an Auto Enlarge feature that automatically fills the page.

The copying functions use HP's CopySmart technology, which automatically makes adjustments for text and graphics, and the machine's digital processing does an excellent job of recreating continuous-tone images such as photographs.

As a scanner, the OfficeJet Pro uses a bidirectional parallel-port connection to send 24-bit images at 300-dot-per-inch resolution to your PC; images can be interpolated to 1,200 dpi. HP's ScanSmart technology automatically identifies areas of text and graphics and makes adjustments accordingly.

The simplified scanning interface lets you define the scan region and choose the type of image, color depth, and scaling. Like high-end scanners, the unit includes a calibration routine for both black and white and color. When scanning with the OfficeJet Pro, you don't get the level of control that you do with high-end scanners, but you do get an interface that produces good results under a wide range of conditions.

The OfficeJet Pro's printing capabilities are likely to make you forget

personal laser printers. With 600- by 600-dpi resolution for monochrome and 600 by 300 dpi for color, you get crisp, clear images even on plain paper. The printer has a full-featured Windows driver, but it has only PCL 3 support in DOS. The printer is rated at seven pages per minute for black text in standard mode

configure your system's parallel port correctly.

It's not surprising to find the bundled software for a hardware product on a CD-ROM, but the OfficeJet Pro comes with two CDs. Both are needed to hold the various applications that come as part of the standard package. In addition to the utilities, drivers, and online help software, you also get Adobe Acrobat Reader, Adobe PhotoDeluxe LE, Caere Corp.'s OmniPage LE, and—if you fill out and return the registration questionnaire—a collection of screen savers.

Supplies should be fairly easy to obtain.

Although it relies on its own print engine, the OfficeJet Pro

uses the same black ink and three-color ink cartridges as the HP DeskJet 680.

The paper-handling features are versatile, designed to handle transparencies, envelopes, labels, and, of course, 8.5- by 11-inch paper. HP backs the product with a one-year parts-and-labor warranty (90 days on the software and ink cartridges).

If you're seeking something for personal use, check out HP's new OfficeJet Series 500. At about half the price of the OfficeJet Pro, it includes fax features but does not scan in color. It won't ship until later this spring.

For the time being, the OfficeJet Pro 1150C does it all—scanning, printing, and copying—economically.

HP OfficeJet Pro 1150C. Street price: \$1,000. Requires: 20MB RAM, 85MB hard disk space, bidirectional parallel port; DOS 6.0 or later, or Microsoft Windows 3.x or later. Hewlett Packard Co., San Jose, CA; 800-552-8500; fax, 800-333-1917; www.hp.com. Circle 412 on reader service card.



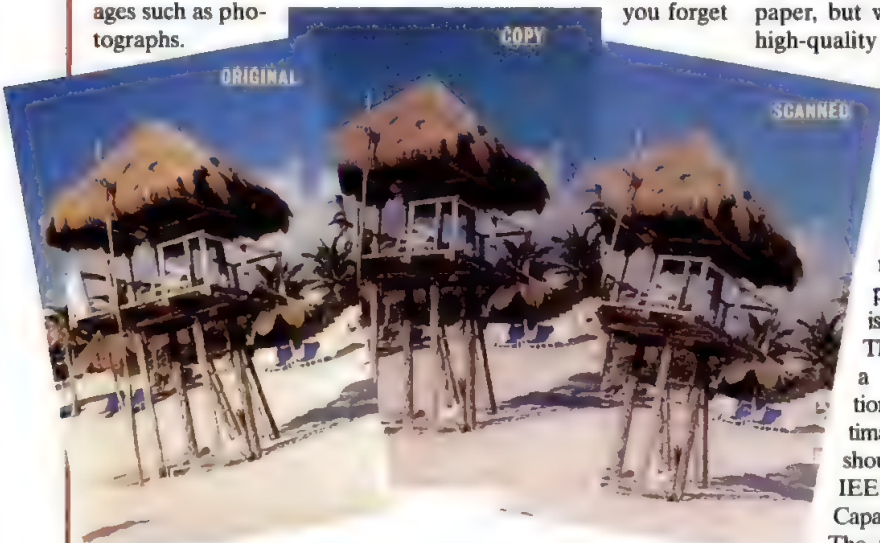
A PRO'S PRO: The HP OfficeJet Pro copies, scans, prints, and produces great graphics. The touch pad/LCD panel (inset) lets you control all available functions.



and eight ppm in draft mode. We measured the OfficeJet Pro's throughput at just over six ppm in a DOS window under Windows 95 without spooling.

Graphics prints were excellent. There was slight banding of photographs printed on plain paper, but when we selected high-quality glossy paper, results were almost as good as the originals.

You can use the unit to scan images into your computer, and all it requires is a single parallel cable, which is included in the box. The unit works with a standard bidirectional port, but for optimal performance, you should connect with an IEEE-1284 Extended Capabilities Port (ECP). The unit doesn't work with an Enhanced Parallel Port (EPP), so be sure to



THREE-FER: The HP OfficeJet Pro's image quality was excellent, but a comparison between its output and the actual photograph suggests it is slightly better for copies than prints.

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Product comparison based on independent third party testing using a 200 MHz Pentium computer with Windows 95. Scanners were operated in best quality mode using Adobe Photoshop, TWAIN drivers and SCSI cards included in the box. Images were single-pass scanned at 400 dpi. Executive Mac bundle also available with Adobe Photoshop LE, ePaper™ and SCSI cable. Other scanner configurations available. EPSON is a registered trademark of Seiko Epson Corp. Expression and TrueScan are trademarks of Epson America, Inc. All other trademarks are the property of their respective owners. ©1997 Epson America, Inc.

CIRCLE 048 ON READER SERVICE CARD



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THE VERSA 7600

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AWARDS



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SAG STA Pentium
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February 20, 1996
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February 20, 1996
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Windows 95

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1 Intel Pentium Pro 200MHz SM
Processor Upgradeable to 2 CPUs

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Expandable to 1GB ECC Supported

Slots: (5) PCI, (4) ISA

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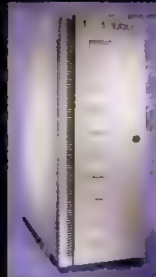
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- 128 MB of Cache



STC7000 RACKMOUNT SOLUTION

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- 2 300 Watt N+1 Hot-swappable Redundant Power Supplies
- Sensor Panel Monitors: - Internal Temperature - Status of Individual Power Supplies
- Status of Individual Cooling Fans - Visual and Resettable Audible Alarm

STC8000 RAID 5 SOLUTION

- 3-Channel RAID 5 U/W Controllers • 8 Hot-swappable Drive Bays
- 2 300 Watt N+1 Hot-swappable Redundant Power Supplies
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- Status of Individual Cooling Fans - Visual and Resettable Audible Alarm

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First Looks

INTERNET ACCESS

Home, Home on the Web

@Home Network and Highway1 change the rules for bringing home the Web.—By Bruce Brown and Scot Finnie

With 56-Kbps modems starting a slow ramp-up, ISDN an unfulfilled wish for many, and 33.6-Kbps analog modems not cutting it anymore for Web access, the field of high-speed data communications is ripe for exploitation. Ironically, it was the business world that demanded ever faster modems and the widespread use of ISDN, but it will be the home PC user who gets the greatest benefit from using the traditional cable network for Web delivery.

We looked at @Home Network with TCI cable and Continental Cablevision's Highway1. It may look like a typographical error, but we were able to download a 6.5MB file in about 30 seconds, compared with at least 25 minutes to download it with a 28.8-Kbps modem.

The first round of commercial cable modems, which are connected to the same wire that delivers HBO, the nightly news, and the Cartoon Network to your television set, delivered these blinding Web-delivery speeds as well. The difference is that with this new equipment, the cable network also can deliver up to 1.5-Mbps data flow to your PC and up to 300 Kbps from your PC.

From a practical point, cable modem access to the Internet is like a network connection at work: always on and waiting to be used. There are no dial-up hassles—just very fast connections.



HOME SWEET WEB: The @Home Network home page lists guides to special-interests sites, plus local and national news and weather.

During our testing of these two cable services, Web surfing was snappy, with graphics often appearing immediately. In fact, these cable systems seemed to deliver data at a speed only slightly slower than that of a local 6X CD-ROM drive. Ranging in price from about \$35 to \$50 per month, a cable modem setup can be cheaper than an ISDN installation—if you can get one—in

most parts of the United States.

As fast and trouble-free as the cable connection is, there are several drawbacks. First, you need a dedicated PC connected to the cable for the system to work; notebooks need not apply. And you must have a free IRQ setting in your PC for the network connection. Third, we were among the first in our area to get connected, but as our neighbors get on the

service is available is hit or miss. But as with cable television, we expect that this service will be available just about everywhere—sooner or later.

@HOME NETWORK

In case you're begging for better Internet access and throughput, @Home Network delivers more of the Web to your house.

@Home Network is currently available via Comcast, Cox, and TCI cable systems in limited areas. We tested the system via a TCI cable connection in the greater Hartford, Connecticut, area. Installation and setup is a bit more involved than with a modem. TCI sent two people: one to install and set up the software and necessary hardware for our computer, and another to install and test the cable connection. In addition, four technicians spent about 2½ hours working on the cable connection. The installation costs \$150 (assuming you don't have an Ethernet card in your PC), and the service sells for \$35 per month, which includes rental of the LANCity Personal Modem and an Ethernet 10Base-T card; taxes are additional.

The system is more than just a high-speed Internet connection, because @Home provides a multimedia Web Guide with many site links, including some to local business-oriented content. Local server caching of popular and regional information ensures high speed response.

A single e-mail address and mailbox are included. Later this year, @Home may expand its offering to include multiple mailboxes, remote dial-in access, and dedicated Web storage space. Multiple PC support via a single modem is also under development; at present it's necessary to have a separately installed modem, network card, and @Home account for each PC.

@Home uses a custom-configured version of Netscape Navigator 3.01. And since you don't have to dial up for a connection,

cable bandwagon, performance will probably slow down—unless cable companies keep up.

Finally, cable modems are strictly for home, at least for now. That's because the LANCity cable modem used by both services we evaluated can't be shared in a network environment. Expect to see LAN-friendly equipment and services aimed at businesses soon.

Living in an area where this

PERFORMANCE TESTS

Cable Internet Services



While @Home Network was in most cases the faster connection to the Web, Highway1 was still much faster than a conventional 28.8-Kbps modem.

Using two Pentium/90 PCs with 32MB of RAM each, we timed how long it took for several Web pages to display and then fully download on two cable networks: @Home Network (via TCI in the greater Hartford, Connecticut, area) and Highway1 (via Continental Cablevision in the Boston area).

Lower scores represent better performance. Seconds	Excite (www.excite.com)		Microsoft (www.microsoft.com)		Netscape (www.netscape.com)		6.5MB download
	First up	Download complete	First up	Download complete	First up	Download complete	
@Home Network	1	5	1	8	1	5	33
Highway1	2	5	1	11	2	4	60
28.8-Kbps modem	2	14	1	26	2	23	2,245

@Home is always there. Most sites come on the screen as quickly as you can type a URL.

Testing at different times over several days found representative sites first appearing on the screen within a second and usually loading in 5 to 8 seconds. Downloading a 6.5MB test file from a variety of national locations took an average of 33 seconds; the average effective throughput was 199 Kbps.

For active home users, @Home gives terrific Internet access and throughput with a local flavor for the normal cost of a single phone line and a commercial online service. It's a win-win situation for all—except perhaps vendors of traditional telephone data services and products.

@Home Network. List price: Installation, \$150; monthly service, \$35. Requires: 16MB RAM, 30MB hard disk space, 16-bit sound card. @Home Net-



LINK-A-RAMA:

Continental Cablevision's Highway1 Web site has dozens of links to intriguing national and regional Web sites, including those in your home town.

work, Mountain View, CA. 888-407-9200, 415-944-7200; www.home.net. Circle 404 on readers service card.

HIGHWAY1

With speeds that are about fifty times faster than an analog modem, Continental Cablevision's Highway1 can quickly change the way you think of the Web. It's always there, waiting for you to use it. Pages snap open: Java, ActiveX, Shockwave, and audio file objects download and display almost instantly.

At \$49.95 per month for unlimited access, Highway1 costs

far less than comparable local ISDN service. The installation costs just \$99 (if you're already hooked up to the cable network), and Continental leases the cable modem as part of the monthly charge. But you need to supply an Ethernet card (\$49), if you don't have one. The whole process took just under 2 hours at our house.

Highway1 service includes a single e-mail account, newsgroup access, and FTP and telnet support. During installation, the service technicians can install a customized version of Netscape Navigator 3.0 with a

bookmark for Highway1's Web site. Like @Home, Continental plans to augment service to the level of an ISP, with dial-up access, Web-page hosting, Domain Name Service, and multiple e-mail accounts.

On our tests, Highway1 was slower than @Home Network, but it was still much faster than a traditional analog modem. We were able to download a 6.5MB file in about 1 minute.

If you live in the right place and think \$50 a month is a reasonable price to pay for blazingly fast Internet delivery, get Highway1. **Continental Cablevision Highway1.** List price: Installation, \$148; monthly service, \$49.95. Requires: 8MB RAM, 30MB hard disk space, Ethernet network interface card. Continental Cablevision Inc., Boston; 800-665-5501; www.highway1.com/. Circle 405 on reader service card.

UTILITIES

Web Central

Starfish Internet Utilities 97 has many must-have Internet programs in a single package. —By Neil Randall

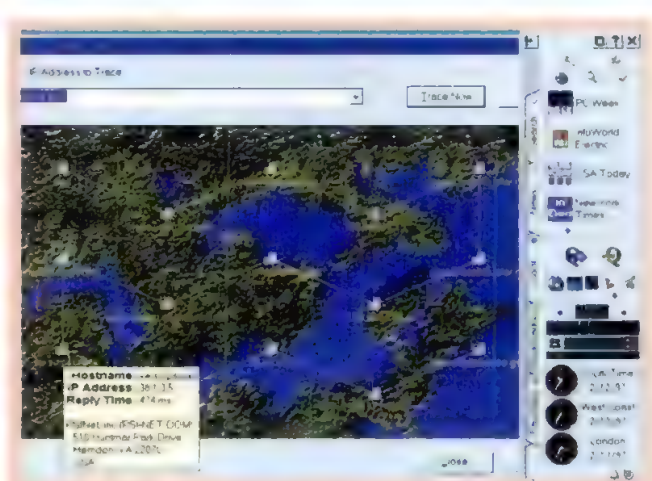
There's nothing in Starfish Software's Internet Utilities 97 (IU97) that you can't find for free on the Internet, but no other package combines so many goodies in a \$30 program.

IU97 makes good use of display space and always has its key functions—utilities, organizer, and Web sites—within one click. The big step forward is what IU97 calls QuickMarks, which are one-click portals to your favorite sites or local resources. You can dock the interface any place you like, shrink it to a multi-tabbed bar that's about the same width as Microsoft Windows 95's taskbar, or have the bar float vertically or horizontally.

When you install IU97, the program creates tabs for News,

Search, Cool, and FTP sites, and adds your favorites from Internet Explorer, your bookmarks from Netscape Navigator, or both. In addition, it will set up tabs for the items on your Windows 95 or Windows NT desktop. Click on one of the tabs and IU97 reveals an icon for each item, and a click on that item starts your access. If your destination is a Web site, IU97 launches your browser and heads for that address. If it's a desktop icon, the desired program starts. If it's an FTP site, IU97 fires up its built-in FTP client and logs on for you.

IU97's news reader gives you quick access to your newsgroups and comes with a binary decoder. You can check accessibility of domain names with the ping client, and you can get machine or user information with the Finger/WhoIs program. On an Internet that's frequently overwhelmed with traffic jams, IU97 tells you where the roadblocks are. QuickRoute traces your packet's route information from your PC to its destination. In addition, IU97's InternetMeter provides statistics



ALL-IN-ONE: Starfish IU97 brings a lot of the Web into one interface.

on your connection. InternetClock not only gives you up to four clock faces with different time zones to choose from, but it keeps your PC's clock synchronized with Internet time servers. Finally, a built-in .ZIP utility performs file-compression tasks and has a virtual desktop feature with as many as nine desktops.

All these utilities and features are available as separate programs with individual interfaces,

personalities, and quirks. Starfish's Internet Utilities 97 provides a lot of Net functions under one well-designed roof.

Internet Utilities 97. Street price: \$30. Requires: 16MB RAM, 5MB hard disk space; Microsoft Windows 95 or Windows NT 4.0. Starfish Software Inc., Scotts Valley, CA; 888-782-7347, 408-461-5800; www.starfishsoftware.com. Circle 406 on reader service card.

First Looks

PRINTERS

Bigger Can Be Better

Tektronix brings the brilliant colors of solid-ink technology to poster printing.—By M. David Stone

Not everyone needs a printer that can produce 36- by 48-inch posters. But in case you need a printer that makes E-size color images, the Tektronix Phaser 600—with a list price of \$14,495—offers output that's eye-catching enough to turn your head.

The natural home for a wide-format printer is a service bureau or an in-house corporate printing department. But with a claimed printing cost of \$2 per square foot (\$24 for an E-size print), the Phaser 600 can pay for itself even if you produce as few as 100 poster-size prints over three years.

Using what Tektronix calls solid-ink technology, the Phaser 600 sprays liquefied colored wax that cools into a solid surface. This lets the Phaser 600 print vibrant colors on anything that can make it through

the printer, not just the rolls of paper, transparent film, and adhesive-backed vinyl that Tektronix sells. The Phaser 600 prints on single sheets as well as continuous-roll stock. Minimum paper size is 8.5 by 11 inches, but the Phaser 600 can produce prints that are as large as 36 inches by 150 feet.

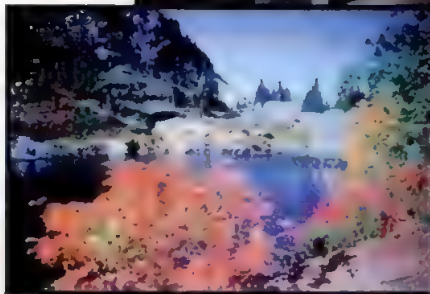
Fully assembled, the 300-pound Phaser 600 stands 41 by 67 by 29 inches (HWD) and rides on four casters. Once in place, you need only insert the solid wax sticks, load the paper, connect a parallel cable and power cord, and install the Postscript driver.

The resulting 300-dot-per-inch output offers vibrant colors for photos and graphics. Particularly when viewed from

at least 3 feet away, the image quality was excellent, good enough for professional-look-



Big: The Phaser 600 produces posters with vivid saturated colors, but it's slow.



ing window displays or company posters.

The best that can be said for the printer's speed is that you'll have your prints sooner than if you wait for the turn-around from a service bureau. Tektronix claims the Phaser 600 can print a standard-mode E-size poster in 24 minutes. Using the highest quality mode, we timed the printing of an image from Adobe Photoshop at just over 1 hour—42 minutes when we used the reprint command for printing from printer memory.

You'll find several time-savers in the Phaser 600. It uses the same sophisticated image-resampling scheme as Photoshop, and you can tell the printer to resample a low-reso-

lution image to improve output quality. This saves time because you don't have to send the resampled data to the printer. Another nice touch is print preview, which prints a small-scale version of each print job for proofing. This generally worked well, except for one image that previewed

as almost entirely black but printed fine; Tektronix couldn't reproduce this problem.

If you can justify getting the Phaser 600, you should get it loaded. The \$11,995 base price includes Adobe Postscript, Level 2, 17 resident fonts, a 1GB internal hard disk, and 8 MB of RAM. But we feel this printer warrants the \$3,000 extended features option, which boosts memory to 40MB, adds 22 fonts, and includes the reprint and print preview features. You can also plug a Phaser Copystation (\$1,695) into the printer's SCSI port, which gives you a large-format copier.

The Phaser 600 is an impressive beast that deserves serious consideration from anyone who needs to make prints as large as life.

Phaser 600. List price: With 40MB RAM, \$14,495. Requires: Parallel port. Tektronix Inc., Wilsonville, OR; 800-835-6100; fax, 503-682-2980; www.tek.com/Color_Printers/. Circle 410 on reader service card.

DISK DRIVES

Next-Gen Floppy Disks

This 3.5-inch floppy disk drive can read and write 1.44MB and 120MB disks.—By Alfred Poor

By using a sophisticated laser-positioning system, OR Technologies' \$190 a:drive sets the pace with a drive that can read and write both standard 1.44MB high-density floppy disks and the new 120MB format.

An IDE device, the a:drive can be configured to take the place of a floppy disk drive as a boot device. But you can only boot to DOS using a standard floppy disk and you can only boot from a 120MB disk to Windows 95. The a:drive requires either

a special controller or an up-to-date PC BIOS. The 120MB disks sell for about \$20 each.

It took us 6 minutes 55 seconds to transfer 50MB of files under Microsoft Windows 95, which is about half as fast as the Iomega Zip drive.

a:drive. List price: \$190. Requires: PC with compliant BIOS. OR Technology, Campbell, CA; 408-866-3000; www.ortechology.com. Circle 411 on reader service card.



NEO DISK: OR Technology's a:drive lets you use standard 1.44MB or 120MB laser-guided disks.

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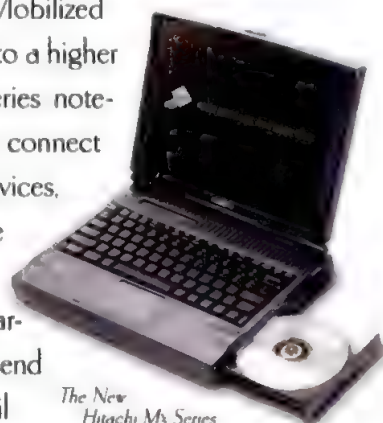
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CIRCLE 082 ON READER SERVICE CARD

First Looks

DATA STORAGE

Mass Data Appeal

SyJet fits 1.5GB of data-storage capacity on its small removable cartridge.—By Alfred Poor

With a capacity of 1.5GB, a price of \$399 (for the internal model; an external model will sell for about \$500), and performance slightly better than that of the Iomega Jaz drive, the SyJet, from SyQuest Technology, seems to be off to a flying start.

The drive uses dual-platter magnetic-media hard disks encased in a hard-shell removable cartridge. The SyJet's key development is what SyQuest calls the cartridge's Labyrinth door seal, which is designed to protect the disks from dust and debris. The flexible door opens to reveal the two disks.

Installation of the internal model of the SyJet was fairly easy. The SCSI ID and termination configurations are set using jumpers on the bottom of the drive. The jumpers are fairly small, and you may have to remove the drive from its 5.25-inch bay carrier rack to reach them, but the documentation covers these steps.

You need to install some included software to get started. The package includes several handy utilities for formatting, copying, and recovering data, and there's also a useful backup program. The drive comes with one 1.5GB cartridge, which contains a game, a directory of ZIP codes and area codes, and a multimedia postcard-creation program.

The drive is rated for a sustained transfer rate of up to 3.7 MBps, with burst rates of up to 16.6 MBps. The 12-millisecond average-access-speed specification rivals that of many of today's fastest fixed-disk drives.

All this added up to a Business Disk WinMark 97 score of 399 thousand bytes per second on a 200-MHz Pentium PC and

a more sedate 294 thousand bytes per second on a 486 DX2/66 PC. By comparison, the Iomega Jaz drive achieved a score of 369 thousand bytes per second on our Pentium/200 test-bed.

The SyJet is more than fast enough—and at 1.5GB, large enough—to be practical for near-line and backup applications. All told, the SyJet managed to back up 48MB of data in 61 seconds on the Pentium/200 test-bed for a throughput of 786 Kbps. This is a good deal better than both the Jaz's time (91 seconds) and throughput (527 Kbps) for the same backup process.

At \$125 each (about 8 cents per megabyte), the SyJet cartridges provide an inexpensive home for all the data that's

been accumulating on your PC's hard disk. The only drawback is that the SyJet cartridge constitutes yet another storage format, one that is not compatible with any other vendors' products or with any prior SyQuest products.

But for a low price, the SyJet provides fixed-disk performance with capacities that rival that of many optical-disk systems. If you're looking for a large-capacity removable disk drive, SyQuest Technology's SyJet is tough to beat.

SyJet. List price: \$399. Re-

quires: 4MB RAM, compatible SCSI host adapter. SyQuest Technology Inc., Fremont, CA; 800-245-2278; fax, 510-226-4108. Circle 403 on reader service card.

BIG SQUEEZE: SyQuest puts 1.5GB of data capacity into its SyJet cartridge.



BENCHMARK TESTS

SyQuest SyJet



The 1.5GB SyQuest SyJet slightly edged out the 1GB Iomega Jaz drive in throughput on the ZD Business Disk WinMark 97 benchmark tests.

We tested each removable disk storage device on a Pentium/200 PC with 32MB of RAM.

Thousands of bytes per second	ZD Business Disk WinMark 97
SyQuest SyJet	399
Iomega Jaz	369

BETTER ▶

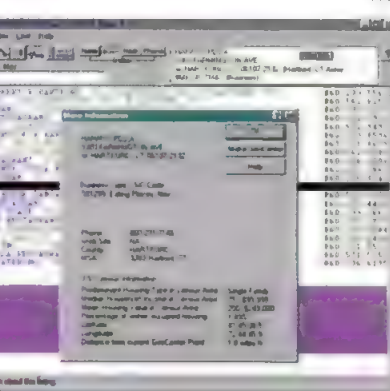
CD-ROM PHONE DIRECTORIES

Where Am I? Who Can I Call?

PhoneDisc's PowerFinder Pro includes GPS support to enable geographic searches.—By Bruce Brown

Telephone reference software reaches new heights with PhoneDisc's \$100 PowerFinder Pro. This product links 115 million cross-referenced residential and business phone listings with census data, the GPS, and Chicago Mapping's Precision Mapping 2.0 Lite (with its maps of every street in the continental U.S.).

If you attach either a Loran or NEMA-183 standard GPS device to your notebook, PowerFinder Pro tells you where you are and gives the distance to the closest ATM or hotel. Just set your lo-



WHAT'S FOR DINNER: When you use PowerFinder Pro with a GPS-equipped notebook, you can search for the closest restaurant.

cation as the Geocenter point and Precision Mapping pinpoints the address on a detailed street map.

Many of the business listings in PowerFinder Pro have buttons, indicating Web sites. Click on the button, and if you're connected to the Web, your Web Browser brings up that page.

When you're traveling, PowerFinder Pro can be a time-saver: If you use it with a GPS receiver and cellular telephone, you won't have to ask for directions. And for homebodies, the residential and business listings are invaluable tools.

PowerFinder Pro. Street price: \$100. Requires: 4MB RAM, 4MB hard disk space, CD-ROM drive; DOS 3.1 or later, or Microsoft Windows 3.x, Windows 95, or Windows NT 3.51 or later. PhoneDisc, Bethesda, MD; 800-284-8353, 301-657-8548. Circle 402 on reader service card.



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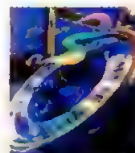
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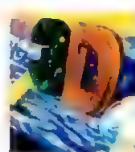
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First Looks

UTILITIES

A Windows NT Safety Net

From disk repair to undelete, Norton Utilities 2.0 makes Windows NT more secure.—By Edward Mendelson

Don't confuse Symantec's indispensable \$100 Norton Utilities 2.0 for Windows NT with its underpowered predecessor, Norton NT Tools 1.0, because Norton Utilities for Windows NT includes the first and only full set of disk-repair and -defragmentation utilities for Windows NT 4.0. The program doesn't match the scope of Norton Utilities 2.0 for Windows 95 (First Looks, February 4, 1997), but some functions—notably the undelete wizard—are more powerful.

This collection of utilities works equally well on FAT and NTFS disk partitions. A powerful undelete feature can restore files that aren't warehoused in the Windows Recycle Bin either because they were overwritten or removed by applications, or because they were deleted from the Windows NT command line. Just click on the Windows Recycle Bin to restore files or use the Recycle Bin's right-click context menu. You can recover files with the wizard-style interface or by selecting them from a list; UnErase also recovers files warehoused by Novell's Salvage feature.

In addition to its essential disk and file tools, Norton for Windows NT includes a system-reporting utility that monitors system data that is otherwise accessible only through a half-dozen separate Windows NT utilities. The utility triggers actions when its sensors detect that performance has fallen below a user-defined threshold. For example, the defragmenter can start up automatically when fragmentation rises above a preset level, or a message can pop up when Internet response time drops.

The actual Internet speed sensors are simply front ends for the

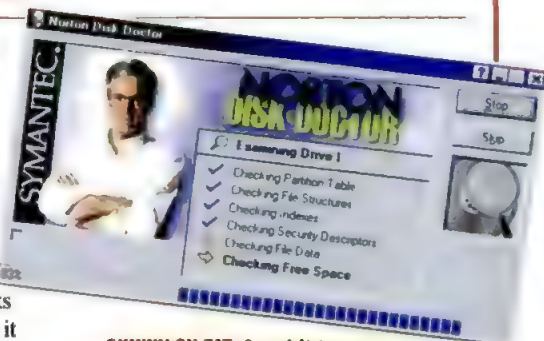
standard ping command; other sensors duplicate information displayed by the operating system's Performance Monitor and by other programs. But Norton for Windows NT's ability to respond to preset sensor levels is unique, and the program adds both a sensor that detects excess faults on self-monitoring IDE drives and one that reports the fragmentation level on any drive.

A ho-hum utility that describes

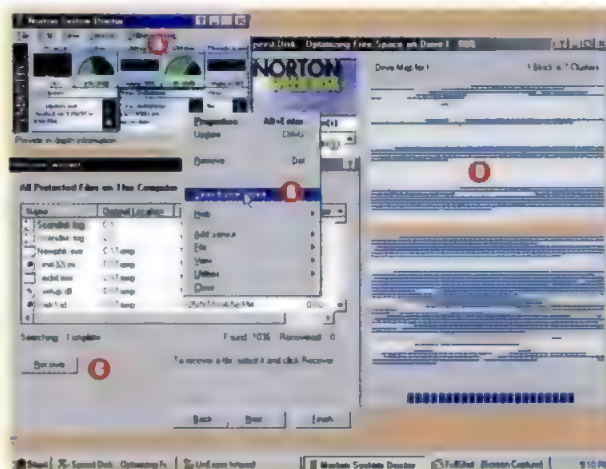
call built into Windows NT 4.0 and moves files only when the operating system decides it can safely move data. By contrast, under Windows 95 a defragmenter locks the drive while it works on the disk.

Under Windows NT, the whole process of defragmentation runs smoothly. In fact, you can set SpeedDisk to run on schedule or continually in the background while you work.

On our tests, the Windows NT



SKINNY ON FAT: In addition to standard FAT structures, Norton Disk Doctor for Windows NT tests NTFS disk structures.



ULTIMATE WINDOWS NT: Norton Utilities for Windows NT combines most system-monitoring and -maintenance tasks into a lucid interface.

- A** Norton Disk Doctor keeps an eye on how well your drives are running.
- B** The LiveUpdate menu connects you to Symantec's Web site and downloads updates.
- C** Retrieve deleted files using Norton's UnErase Wizard.
- D** SpeedDisk uses Windows NT to defragment drives.

your computer's configuration—though not quite accurately—rounds out the package. Unlike Norton Utilities 2.0 for Windows 95, the Windows NT package doesn't include low-level disk-editing tools, because the NTFS file system doesn't allow direct access to the disk.

In appearance it's a dead ringer for the Windows 95 SpeedDisk defragmenter, but below the surface the Windows NT variant is all new. Rather than move files itself, SpeedDisk uses an Application Program Interface (API)

SpeedDisk didn't pack files as tightly on either FAT or NTFS partitions as the Windows 95 SpeedDisk packed them on FAT partitions. We found, however, that repeated background defragmentations produced the best results. The program makes no attempt to move the NTFS Master File Table.

Norton Disk Doctor (NDD) performs like its Windows 95 counterpart on FAT partitions and adds detailed testing of NTFS security descriptors and other features. Some NTFS testing re-

quires exclusive access to the drive, and operations may require that you schedule a repair the next time you start Windows NT.

A big help is that partitionable repairs can be reversed from undo data stored on a floppy disk, but you have to be able to boot into a functioning Windows NT system to perform this task. Unlike Norton Utilities for Windows 95, the Windows NT version can't create an emergency disk that lets you attempt to repair your system when you can't access the hard disk.

Everything in the program reflects Windows NT's security-minded approach. You can only install the program if you have administrator-level access to the system, and you can choose to install it on all users' profiles or only on a specified profile. And to keep users from mucking around with their disk drives, NDD can only be run by users with administrative access.

Like the Windows 95 variant, Norton for Windows NT has a LiveUpdate button for quick delivery of program updates and bug fixes direct from Symantec's server. A beautifully designed and highly polished tool, Norton Utilities 2.0 belongs on every Windows NT system.

Norton Utilities 2.0 for Windows NT. Street price: \$100. Requires: 16MB RAM, 25MB disk space, Microsoft Windows NT 4.0 or later. Symantec Corp., Cupertino, CA; 800-441-7234, 541-334-6054; www.symantec.com. Circle 401 on reader service card.



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a c c e s s

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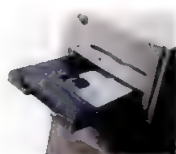
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First Looks

UTILITIES

Streamlining FTP

Accessing FTP sites just got a lot less complicated with Anawave's FTP Icon Connection.—By Neil Randall

Anawave Software's \$30 FTP Icon Connection 2.5 makes it easier than ever to download files without knowing any of the File Transfer Protocol's (FTP's) arcane commands. The bottom line is that while there are more complete and powerful FTP clients available, none is easier to learn or use.

FTP IC offers a two-pane graphical interface that's similar to that in Microsoft Windows 95 Explorer. There's also an assortment of icons that produce direct connections to a variety of FTP sites in three categories: hardware, software, and publications. Simply double-click on any of the icons and you're connected. You see the site's contents displayed as folder and file icons in the right pane, and as Explorer-like nested listings in the left pane. After that, double-click on remote directories until you see the file you want, and then double-click on the file to start downloading what you want.

The program automatically downloads files to a default directory, which you can specify in the Options dialog box. If the file type has been associated with a particular application in Explorer, FTP IC brings up the application as well as the file. Without question, this is a powerful and easy-to-use feature, and one that exemplifies FTP IC's attempt to emulate the standard Windows 95 interface.

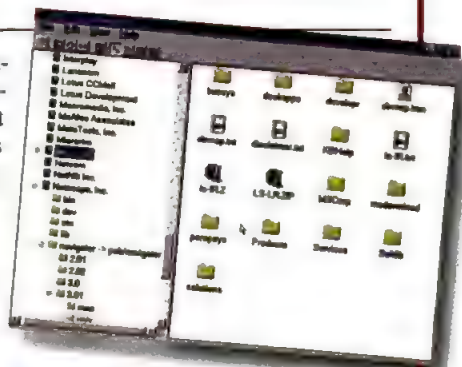
But when double clicking doesn't work (the program had trouble with some symbolic links on remote Unix systems), figuring out what to do next is far from intuitive. The answer lies in the link between FTP IC and Explorer. If you want to download files into specific

local directories without constantly changing the default download directory, open Explorer and drag the file from FTP IC's remote window to the appropriate directory in Explorer. Although this works well, it's clumsier than the dual-machine windows used by Ipswitch's powerful WS_FTP Pro and other FTP clients.

But with FTP IC's Explorer-like sorting capabilities, its strong support for proxy servers, and its graphically appealing icon-customization feature for adding your favorite sites, FTP Icon Connection is a good choice for users who don't want to become involved with the nitty-gritty of FTP.

FTP Icon Connection 2.5.

List price: \$30. Requires: 8MB RAM, 5MB hard disk space; Microsoft Windows 95 or Windows NT. Anawave Software



ICON EASE: FTP Icon Connection lets you click your way to FTP sites.

Inc., Newport Beach, CA; 800-711-6030, 714-250-7262; www.anawave.com. Circle 408 on reader service card.

INTERNET UTILITIES

E-mail Attachments with Ease

Whether an e-mail attachment arrives encrypted, compressed, or in an oddball format, DataViz's e-ttachment Opener can read it.—By J.W. Olsen

You receive an e-mail message containing uuencode or BinHex hieroglyphics. Or perhaps you download a compressed .TAR or .ZIP file, or a colleague sends you a MacWrite document. DataViz's \$40 e-ttachment Opener 1.0 is an easy, one-size-fits-all program for reading most popular formats not directly accessible to Microsoft Windows 95 or Windows NT users.

There are three ways to use e-ttachment Opener. The most innovative way translates MIME, uuencode, or BinHex gobbledygook in e-mail and displays it in its native format.

You begin by copying the entire message from any e-mail reader to the Windows clipboard. Then launch e-ttachment Opener's e-Mail File Extractor module and name the destination folder for the attachment. The program converts and saves the file.

Though this method was fast and hassle-free, it was some-

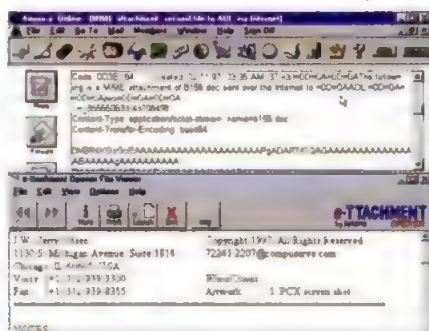
what awkward. Our only regret is that you must manually invoke e-ttachment Opener's Extractor; you can't just drag and drop the message.

The program's second module, e-Navigator, accesses the decoded file as if it were any other

most popular PC and Mac word processor, spreadsheet, database, and graphics formats—even if you don't have the applications. Although Drag and View and Quick View Plus may be slightly better at handling PC-based files, e-ttachment Opener is an adept alternative, and it excels with Mac-based formats.

Finally, e-ttachment Opener adds options to context menus within Explorer. This means you can view any file that the program understands. e-ttachment Opener's underlying file-viewing engine is a subset of the formats supported by DataViz's package, Conversions Plus, which is expected to be updated this summer.

Even if you have utilities to handle files for which you don't have associated apps, e-ttachment Opener is invaluable in today's polyglot e-mail world. **e-ttachment Opener 1.0.** Street price: \$40. Requires: 4MB RAM, 9MB hard disk space; Microsoft Windows 95 or Windows NT 4.0. DataViz, Trumbull, CT; 800-733-0030, 203-268-0030; www.dataviz.com. Circle 407 on reader service card.



TOWER OF BABEL: Return e-mail gobbledygook attachments to their original formats with DataViz's e-ttachment Opener.

file on your system. This module resembles the dual-pane Windows 95 Explorer, but unfortunately it has only a modest subset of Explorer's functionality.

As with Canyon Software's Drag and View and INSO's Quick View Plus, you can view files—including such compressed archives as .ZIP files and those in

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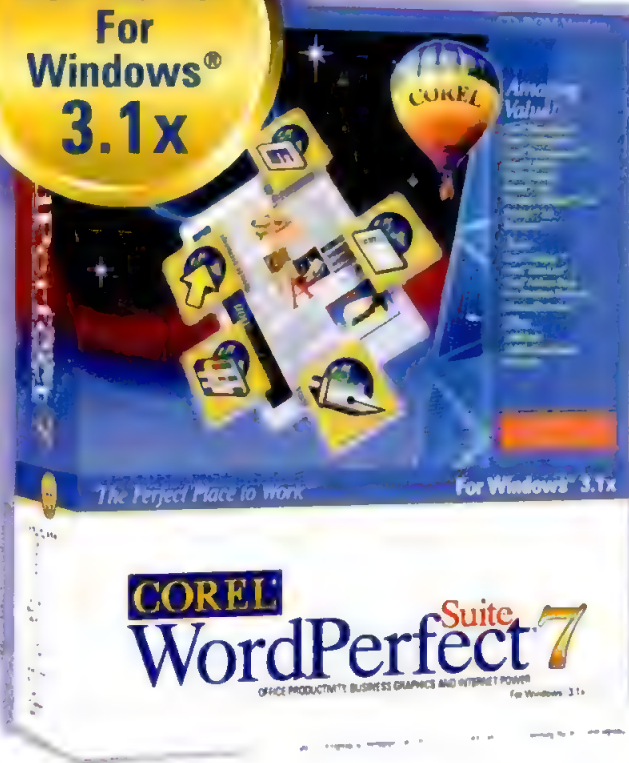


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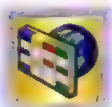
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Second Looks

SUITES

Filter Frustrations

As an avid user of two of the three major application suites, I often find myself between a rock and a hard place when I try to move text between them. Sure, each suite has an extensive array of import and export filters for the other's products, but each remains a world unto itself. When translating another program's secrets, the conversion process is at best a generation behind the times, and even at that it's more art than science, so I'm always ready for frustrations galore.

A truism of today's PC world is that the more complex the starting document, the more trouble you have reading it with any competing software. For example, you save your highly polished text in product A (no names, please), but when you view the document in product B, it looks as if a tipsy gorilla typed it.

Corel WordPerfect Perfect Office 7 and Microsoft Office 97 are far from immune to this problem ("Suite Deals," February 18, 1997). For example, though you can open a WordPerfect 6.0 document in Microsoft Word 97, chances are that you won't see the whole picture.

And in addition to some minor inconveniences—the loss of drop caps and the lack of support for line numbers, for two—in the aftermath of the conversion process, you usually have to spend a substantial amount of time tweaking margins.

The other side of the suite street is even worse, because you can't open or save a Word



97 document in WordPerfect 6.0 format at all. When you try, you get mysterious error messages—File Unknown and The File cannot be Found. The only workaround is to save the

file using the WordPerfect 5.x for Windows setting in Office 97 and then reopen the file in WordPerfect.

So if you're a suite hopper, keep an eye on each vendor's Web site for viewers and filters for its—and its competitors'—newest products.

Keep in mind, though, that by the time updates appear, many of us will have moved on to newer versions of these programs, leaving us right back where we started.

In addition, such products as DataViz's Conversion Plus and INSO's QuickView Plus help, but they are also a step behind the times.

CAD

Drawing On the Web

AutoCAD's .DWG file format is without a doubt the professional standard for architects and designers ("First Looks," February 21, 1995). But with drawing files typically running several megabytes in size, this format is too cumbersome for distributing drafts and completed drawings over the Web or via e-mail.

Autodesk's Internet Utilities

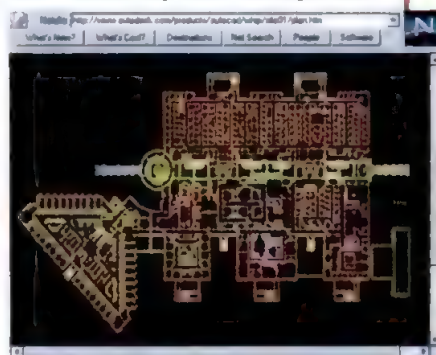
and its Drawing Web Format (.DWF) file specification hope to put an end to that. The reason: .DWF files are about one sixth the size of original .DWG files, and you can embed URLs on any drawing to make it a Web centerpiece.

With Autodesk's Internet Utilities, you can convert any AutoCAD .DWG drawing into a Web-ready .DWF file within AutoCAD, Release 13. And though it's a faithful representation of the original drawing, the .DWF file is a snapshot that doesn't contain any of the data that lies behind the image.

You can view .DWF images in your Web browser—courtesy of Autodesk's Whip viewer, which is available at Autodesk's Web site (www.autodesk.com). The plug-in for Netscape Navigator and the ActiveX component for Microsoft Internet Explorer both work equally well.

We downloaded and worked with a variety of .DWF files, ranging from building plans to maps to technical drawings of

car parts. The best feature is the ability to pan and zoom around a .DWF file with surprising speed and accuracy. For example, after we zoomed in all the way on a drawing, its let-



tering and lines were still pinpoint sharp; a comparable bit-map image becomes increasingly fuzzy when you zoom in this close.

What you can't do is mark up or annotate .DWF files, although Autodesk is currently working on adding that ability to a revision of the product.

SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Brian Nadel via MCI Mail (556-1500), CompuServe (72241.1616), or the Internet (bnadel@zd.com).

BUG BRIEFS

Problem: The Epson Stylus 500, the Editors' Choice—winning color ink jet printer, won our praise for quality output, but the Macintosh version ("Personal Printers Showdown," November 5, 1996) was slow.

Solution: To speed up printing significantly, go to the Epson Web site (www.epson.com) and download the latest revision of the Mac drivers.

Problem: Some users of PCs with Hercules Terminator 3D Power graphics cards have reported trouble loading Norton Utilities for Windows 95 (First Looks, February 4, 1997).

Solution: On the Hercules Web site (www.hercules.com), you can get the latest video drivers, which should eliminate major conflicts with Norton Utilities.

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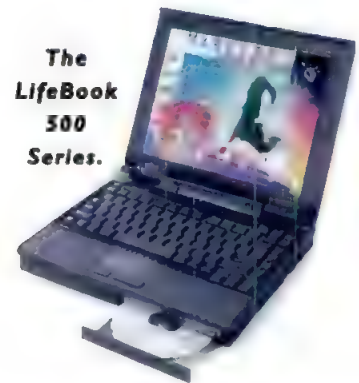


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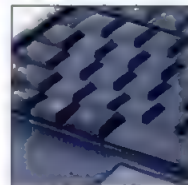
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The Digital Scapegoat

I'm not a big TV watcher, but I do keep an eye on the evening news programs and CNN Headline News, just so I know what's going on in the world. Sometimes I like the coverage even less than what's being covered. Within the last couple of weeks, I've watched

at least half a dozen stories or special reports that focused on the Internet. Each began with a reporter at a crime scene or other telegenic locale. Jane Perky or Harry Hair-slick would intone the reports, warning viewers of the evil influences lurking just beyond their keyboards.

The following excerpts aren't verbatim, but they're pretty darn close:

Pornography is on the rise, much to the consternation of public officials. They cite the Internet as a major source and distribution medium. . . .

The FBI recorded nearly 2,000 bombings in 1995, which injured or killed 594 people. Bombing is on the rise, as more people vent their frustrations and express extremist points of view through violent means. It's easier than ever to learn how to make a bomb. On the Internet you can find. . . .

Jane Doe was the victim of a stalker. It started innocently enough, with an exchange of e-mail and visits to a chat room in cyberspace. Then, through the Internet, the man who called himself Loki. . . .

Runaway children know no social or economic level. And their numbers are rising rapidly. In case after case, children cite someone they met in a chat room on the Internet as an influence. . . .

I really don't have much of a temper, but stories like these put me over the top. The last one caused me to start yelling at the TV, "The Internet! The Internet! The Internet!" My kids backed slowly out of the room with that worried/amused expression that meant old Dad had finally lost it, but they half feared I was going to start shooting at the set.

Stalkers, pedophiles, bombers, and pornographers are real. But when's the last time you saw a TV crew reporting from the parking lot of the adult bookstore? Or excoriating a newspaper for those transparent classified ads for "young models"? My buddies and I made some nasty, noisy concoctions from the classic guerrilla chemistry book, *Fortunes in Formulas*. Where was the anchorperson warning the public that this tome was a threat to society?

I don't see scare stories like the above in any other medium. Newspapers and general-interest magazines give

the Web balanced coverage. Common sense tells us that if there's a medium, some people will figure out a way to exploit it or the people who use it. The public needs to know as much about the dangers of singles bars, classified ads, confidence games, and pyramid schemes as they hear

about the Web's supposed dangers. Instead, we get this incredibly lopsided coverage. Here are a few theories on why this may be so.

1. TV can't cover the Internet. Web sites look dumb and static on television. Online chatting looks moronic. So the only way to build in some excitement is to focus on negative stories.

2. TV subconsciously fears the Internet as a rival medium and tries to inculcate a sense in its audience that TV is the watchdog medium, there to protect an unsuspecting public. "Count on us to keep you informed," they're implying, "of the goings-on in this unruly, threatening new medium." Several recent surveys confirm that Web surfing time is coming out of TV's hide, so their fears are genuine.

3. Television excels at making people feel that the stars of its shows, especially the sitcoms and late-night shows, are your friends and peers. It also presents lowlifes extraordinarily well. Any time you're feeling bad about yourself, take a gander at the creeps on the afternoon talk shows or the manufactured meanies in the soap operas. Once you've tired of making your audience feel superior to people meaner and dumber than them-

selves, the only frontier left is to make them fearful of people smarter than themselves. You must be some kind of smart guy to use a computer and all that Internet stuff, and the leap from there to evil genius is a short one.

4. TV will always seek the man-bites-dog story, and there are more interesting and offbeat things going on at the forefront of technology than in the usual haunts. A "dark side" hook makes the story all the more interesting.

Perhaps I'm hard on television, but such a ubiquitous, influential medium must adhere to the highest standards. It must go beyond sensationalism and the story of the moment into balanced, informed reporting. We're not there yet. □



NET SCARE STORIES

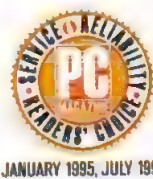
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Dvorak's Fail-Safe Advice

If you lose a major component of your personal computer system, is there a way you can continue to work? It turns out that few people are prepared for a mishap. Most people don't have a UPS to prevent data loss. My advice is to get out your wallets

(or roam your closets) and save money by being prepared.

Here's some background. I was instant-messaging a friend online, and in the middle of the conversation my system's keyboard died. This is not an unusual occurrence for me. Except for one old Amiga keyboard, I break about one a year. Luckily, I have a closet full of keyboards. It's great to just pull one from inventory rather than having to go out and buy a new one. While I don't think we should all wear belts and suspenders, I find it necessary to have each component backed up. I recommend a few things you should do to back up your hardware. This is the Dvorak Fail-Safe System.

Let's start with the computer itself. Few of us have a spare CPU that we can pull out of the closet, though many have a laptop with desktop power that can be hooked directly or through a port replicator to the monitor, keyboard, and mouse. Those prepared for such an event should have an Adaptec slim SCSI PC Card that would link to the desktop SCSI chain of peripherals. Others without a laptop have hopefully passed older computers along to spouses or children. These can be commandeered in a pinch.

The typical system failure is usually caused by a blown power supply. When junking old computers most people salvage a floppy and maybe a disk drive, but few think to salvage the power supply. Check it out before you toss it. It's nice to have a spare handy.

Hard disk failure. If you have no backup laptop or other machine in the house, you should be concerned about a hard disk failure. There are a number of external options. The SCSI I/O can save the day if you have some sort of external storage based on a SCSI chain. Even a 230MB optical drive can be used as a boot drive; Olympus makes an inexpensive and high-performance portable 230MB optical drive. Then there is the combination PD-CD drive from Panasonic. I have one of these drives and have used it as an emergency boot drive for a Macintosh system. Then, there are the high-end Tahiti drives and the excellent SyJet from Syquest to look at. Any one of these devices can act as a

disaster-avoidance measure and temporary fix. Of course, make sure to plan to have the right software and data available on these external systems.

The keyboard dilemma. While CPU and disk failures are major breakdowns, a keyboard or mouse failure can be just as catastrophic in the short term. While it's possible to manage without a mouse, there's not much you can do without a keyboard. The whole system may as well be down. I recommend that everyone have a backup keyboard. There are two ways to go about this. One is to assume that the keyboard and mouse you got with your machine are cheapies used to keep the system cost down. Get yourself a high-quality keyboard and put the original in the closet for backup. Same with the mouse.

You won't regret this decision. It is likely that both will eventually fail. If you intend to use the keyboard or mouse from a hand-me-down system, make sure the connectors match your machine. Older systems often have a huge keyboard connector, while most new PCs are equipped with a PS/2 connector. Everyone should have a keyboard-to-PS/2 adapter, which can be bought at most local clone shops for a few dollars.

Modems. Few people consider a modem as a vulnerable component that should be a target for backup. I've blown at least six modems over the past decade. Luckily I've kept my old modems. When

I switched to a 14.4-Kbps model, I was left with a 9,600-baud modem that I used as a backup when the newer one eventually died. I know that most of you—like me—pass out old modems to newbies who need one. Tell all those people to whom you've given your modem to upgrade now. And do so yourself.

The rest of the system, such as the printer or even a floppy disk, shouldn't keep you from working in the event of failure. The monitor might be a problem except for laptop users. Most serious computer users are networked in some way and often work with disabled systems. But we seldom consider the consequences of computer failure. Have a contingency plan ready.



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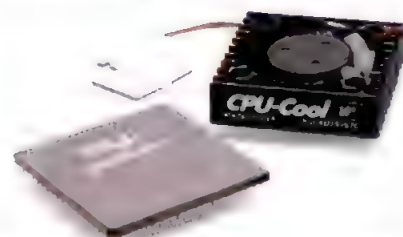
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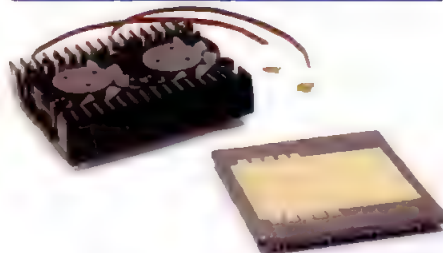


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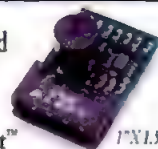
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Inside Track

Klamath, Klamath—**Who's Got the Klamath? Dept.:** Over the past month or two we've watched Intel's tale wag the media dog as the Klamath delay is

interpreted as a strategy, when in fact such delays are always caused by manufacturing or design problems. The new package for the Klamath may be part of the problem, as the on-board cache was moved around. Now the word is that the 233-MHz version of the chip may never go into mass production and we'll see only a 266-MHz model. Knowing the way these chips are specified, I'd conclude that Intel intends to start with its **300-MHz design**. The 266-MHz chips are 300-MHz rejects that can't meet the specs. This, as far as I know, was the original plan for the Pentium Pro MMX rollout, as Intel first told vendors in early 1996. The 233-MHz PPMX chip may be a red herring to lure AMD into that category. The big question is, when can Intel actually produce the 300-MHz part?

Meanwhile, Here Comes the 4-Gigabit Chip Dept.: In early February, NEC announced it had developed a **4Gb DRAM chip**, which it intends to have available in quantity within three years. While this kind of jumps the gun, it gives us a hint as to what kind of computer we'll have on our desktops next century. I expect every other RAM maker to come out with similar claims. Of course, NEC made its announcement just after Hitachi, Mitsubishi, and TI announced a joint venture to make **1Gb DRAM chips**. The phrase of the month covering these new processes is **giga-scale integration**, or GSI. It replaces large-scale integration (LSI) and ultra-large-scale integration (ULSI) as the moniker. I expect to see a machine with **1Gb of RAM** to be sold to the public within the next five years. It will be needed to run Microsoft Office 2001. Today, the typical memory chip is 16 megabits, with 64Mb chips coming into the market; 256Mb is next, then 1Gb. Time for you CP/M users to think about an upgrade.

In other chip news, there seems to be a concerted effort on the part of the Japanese to make **single-chip MPEG-2 real-time encoders**. NEC and Sony are both trying to develop this technology, and both companies talked about it at the International Solid-State Circuits Conference. Sony's design is more interesting, since it uses a versatile DSP engine built around a 0.4-micron-semiconductor, three-metal-layer CMOS-logic process to do the job; the 3.3-volt chip runs at 81 MHz. Expect to see chips on the market in 1998. You're getting TV and movies on your system whether you want them or not!

Microsoft in Court Again Dept.: Microsoft has been taken to task by the state of Texas regarding the com-

Over the past month or two we've again watched Intel's tale wag the media dog as the Klamath delay is interpreted as a strategy, when such delays are always caused by manufacturing or design problems.

pany's online travel service Expedia. Apparently the state is trying to protect SAABre—the American Airlines (AMR Corp.) service based in Texas. The state is asking Netscape to help it discover unfair practices that Microsoft might employ. The potential beneficiary here is Travelocity, a travel supersite jointly developed by SAABre and Worldview using Netscape software. Microsoft says that **Netscape is behind the suit**. This will be fun to watch.

If that doesn't create enough of a headache for you, then watch the merry-go-round to nowhere unfold in the next few months as various **Java operating systems come and go**. First there was the Javasoft

proposal to employ JavaOS on DOS as an alternative OS. Yes, let's keep DOS alive! JavaOS is optimized for a NetPC, a low-budget system proposed by Intel and Microsoft to compete with the NC, or network computer. Javasoft prexy Alan Baratz says this cool new OS can easily be replaced with Windows 3.1 when you need Windows compatibility. The idea is to muddy the waters while **claiming** you're doing people a favor. Yeah, there's a step forward.

Then there is the interesting news about a **competitive OS called JVOS**. It installs on an embedded OS used in Japan called micro-Itron OS. It can coexist with Windows 95 on a system with a boot manager. Curiously, JVOS is based on the **Asymetrix SuperCedeVM**, supposedly the fastest Java virtual machine there is. The big gripe against Java is that it is as **slow as a slug**, especially when doing math. Adding more intrigue is that Asymetrix is owned by Microsoft cofounder Paul Allen. Toshiba is talking about using it, and NetPCs and NCs are other targets for this technology. If you have any theories, I'd like to hear about them.

Readers should contrast a couple of interesting trends here. First look at the chip trends as outlined at the beginning of this column. It's a **mad rush** to increased performance and lower prices. This has always been the trend in computing. Measure this against the scramble to save money on a per-computer basis. It's smaller-cheaper-faster versus cheaper. In fact, **both trends are the same**. It's just that "cheaper" doesn't mention smaller and faster.

What's really going on is that the collective subconscious of computing is trying to give us a sub-\$500 machine. The palmtop people almost have it right, but they **don't get it** either. People who go out and buy used 286 and 386 machines prove there is a market. In fact, you can go find an old clunker for \$200 if you want one. These machines were state of the art ten years ago and are still functional today. All they don't do is run **modern bloatware**. And I'm not so sure that's bad. □



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Go Wireless Today, Not Someday...

It's generally accepted that all communications are headed for a wireless future. Today that move is still not yet feasible: Bandwidth limitations, technical problems, and the capital costs of the yet-to-be-built wireless infrastructure stand in the way. But it's

coming, as sure as tomorrow. And it's going to change how we think about communications.

For PC users, universal, continuous, wireless connectivity will also change how we work and how we envision the role of PCs in our worklives. But we don't have to wait for the build-out of that wireless infrastructure: We can enjoy the benefits of continuous, nonstop connectivity right now, within the confines of our offices. And I can tell you from personal experience, that will change how you use your notebook PC. The secret? Wireless networking added onto your existing local area network.

Wireless networking isn't a new idea, and it isn't a new product category. We've had good wireless LAN extension products available from Xircom and Proxim for a few years now, though they've been little noticed and less used. But Proxim recently shipped a new set of products incorporating a complete overhaul of their wireless networking technology. Based on 2.4-GHz frequency-hopping technology, it offers a level of reliability I've never found in wireless networking.

(A bizarre factoid: The frequency-hopping technology everyone's starting to use for wireless communications is covered by a patent issued to no less than 1940s Hollywood bombshell Hedy Lamarr, who learned about radio technologies at the dinner table with her first husband, an Austrian working with Nazi military leaders in the late 1930s. She fled him and Austria for the U.S., made her mark in Hollywood, and, together with modernist composer George Antheil (*Ballet Mécanique*), developed the basis for her patent, which is now making her very rich.)

Proxim's system adds a \$1,895-list AP-II AccessPoint base station to your LAN, and adds to your notebook a \$695 RangeLAN2 7400 PC Card transceiver (with either a plug-like antenna sticking out of the PC Card or a tiny rubber-duckie antenna stuck on the lid of your notebook). There's nothing very tricky here: The system has the usual NDIS 2.1/3.1 and ODI client-side network drivers, which work well.

The first thing you'll notice is how nice it is to be able to

wander anywhere in your office with your notebook, staying connected to the LAN throughout. Even if you're not the sort today who likes to carry your notebook from office to conference room to conference room, taking notes in meetings, I predict your first taste of intraoffice wireless

networking will change your habits. You may not turn into an obsessive notetaker, nor even a PC-notetaker—I still take notes, silently and more or less discreetly, in college chem-lab-style sewn-binding notebooks, most of the time—but you will get hooked on the ease, convenience and productivity of having your network resources available all the time.

Being able to call up a file, poke around in a network-resident database, or check a shared calendar for available follow-up-meeting dates—instantly, not later, back in your own office—is heady stuff, indeed. Especially with no wire trailing out of the side of your PC and snaking over to plug into the LAN jack in the wall—at least until someone trips on that wire and pulls your notebook crashing down onto the floor.

Heady, sure—and potent, too. This isn't wireless Nintendo for adults, but conducting business 1997-style. (It had better be, to justify spending four times the cost of a conventional wired 10Base-T PCMCIA LAN card on that wireless card.)

You'll also need to resist some bad habits. More than once, in a dull meeting, I've slipped into reading and answering e-mail while trying to look engaged and

interested. Unless someone takes a look at your screen—you'll start using smaller fonts and a lower brightness setting on your PC's display to discourage that—they won't be able to tell whether you're an industrious, hard-working, well-connected fellow, or a devious, bored clown trying to escape the tedium of the meeting by retreating into e-mail.

Actually, matters will probably reach a point in your company, as wireless networking spreads, where reading and answering e-mail during slow moments in meetings isn't seen as bad manners, but as making the most of your time. I've seen that cultural-change/attitude-change in



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AcerView™ Quality Monitors

JIM SEYMOUR

offices where wireless networking is commonplace, and while I don't necessarily think it's a good thing, I confess that I have begun to move in that direction, too.

If the first thing you notice when you begin working with a wireless-LAN-connected notebook is the ease and convenience of carrying your notebook with you, connected, anywhere in your office, then the second thing you'll notice, probably, is that the LAN seems to run slower. It does. Standard 10-Mbps Ethernet may not always deliver a true 10-Mbps datastream, but even the best wireless LAN extensions, such as those from Proxim and Xircom, run at 1.6 Mbps, on average about five times slower than what you're used to seeing on your desktop.

But put that in perspective: Apart from the fact that it's well worth the price you pay in raw speed to get the convenience of wireless connectivity, does the difference between 8 to 10 Mbps and 1.6 Mbps really matter to you? You're probably not downloading huge files, and you're certainly not backing up a 1.4GB hard disk over that connection.

My answer is that the speed difference doesn't matter a bit: I happily pay the price of sometimes waiting an extra half-second in return for not having to haul a wire around with me, grub around under desks, tables, and chairs—and not worrying about some klutz tripping over that wire and taking my notebook down with him.

You can buy standard ISA (but PCI) cards from Proxim for a RangeLAN2 system, and that makes sense for distant desktop PCs—say, in a warehouse—where wire-pulls would be difficult and expensive. Wireless networking can also be convenient and cost-effective when you have to get a small network up very fast, or when you need to move a small LAN from one location to another, then another, then another.

I should add that you may need two or more Access Point base stations to ensure connectivity over a very large area—and remember, those base stations have to plug into a network jack. I get reliable coverage over a rectangular 10,000-foot-plus office area, but in larger areas, mounting two Access Point stations near the ends of a typically rectangular office area may be necessary.

Wireless will inevitably edge out wired connections for virtually all our communications needs over the next decade. You don't have to wait: Wireless connectivity for PCs is here today—not cheap, but often a bargain. □

Taking Multimedia with You

When it's show time on the road and you have a presentation to give, these days you won't need to bring along so many roadies to help with the heavy lifting. Credit this to the evolution of LCD multimedia projectors that can fill most any room with a brilliant

image. These devices—about the size of pumped-up slide projectors—take input from your notebook or VCR and project it (usually) through a trio of LCD panels.

Recently, *PC Magazine's* 100-plus staff spent several days on a goal-setting retreat. In years past, we air-freighted in a three-beam projector the size of a dorm refrigerator. They rent for about \$750 to \$1,000 a day, including the full-time A/V guy you need to twiddle and adjust the three color beams.

This year we brought along a multimedia projector. The results were, in a word, sensational. All you do is take it out of the case, connect the power and signal, turn it on, zoom the lens to fill the screen, and focus. No muss, no fuss, no alignment problems. We were able to light up a 10-by-14-foot screen and still leave the room lights halfway up—enough to allow note taking. The projector switched effortlessly between a notebook display and a focus-group videotape. The unit we used, the Toshiba TLP-411 MediaStar (\$8,995 list; 800-631-3811, www.toshiba.com/tacp), was unique in that it also has a third input, a built-in document camera on a swing-up arm that can zoom in on something the size of a credit card.

You can spend \$3,000 to \$9,000 for a multimedia projector (also called a data, LCD, or portable projector). The cheaper units are VGA only, have a light output of about 250 ANSI lumens, and are meant for medium-size rooms. The costlier ones do SVGA (800-by-600), handle 1,024-by-768, have a light output of up to 500 lumens, and can project an image up to 25 feet across.

Bells and whistles may include a zoom lens, a wireless remote for switching inputs and for adjusting focus, built-in mono or stereo speakers for audio output in smaller settings, and a video pass-through so that the presenter can view the image on a nearby monitor or TV. Most multimedia projectors use metal halide bulbs that cost several hundred dollars and last for a couple of years. Unlike the quartz bulbs in overhead projectors, they aren't very fragile and don't suddenly burn out. Some project light through three LCD panels that always stay in alignment—unlike the bulky, bar-room-style three-beam projectors that project light from

three black-and-white CRTs (covered with red, green, and blue filters). Others use Texas Instruments' promising digital light processing (DLP) device. These projectors weigh 10 to 25 pounds and fit in the overhead bins on airplanes (the Toshiba just barely made it). You can choose among a dozen vendors, including Boxlight, CTX, Epson, InFocus, NEC, Polaroid, Proxima, Sanyo, Sony, 3M, Toshiba, and ViewSonic. By midyear we'll begin seeing true 1,024-by-768 devices.

Here are some things we've learned about data projectors and portable presentations from our recent experiences:

- Experts say the costly three-beam projectors do a better job of rendering life-like video images (TV, VCR). We found the multimedia projectors, however, to be more than adequate.
- You get what you pay for (and lug). The heavier, costlier multimedia units yield brighter, crisper images. No matter what their cost, you'll recoup your investment quickly if you've been renting a three-beam projector half a dozen times a year.
- There's no comparison between a multimedia projector and an LCD panel plunked down on the hotel's overhead projector. The multimedia projector wins hands down.
- When you're not on the road, you can use the projector in a fixed location in your office. Most can be used for a ceiling mount or rear projection.
- If audio quality is critical and you're playing to a small or medium-size group, bring your own amplified speaker system. The best we've seen is the compact, three-piece Cambridge SoundWorks Model 12 (\$799.99 direct; 800-367-4434, www.hifi.com), which includes a subwoofer.
- You don't want to be tethered to your notebook PC when advancing slides. Carry a wireless mouse or pointer from a vendor such as Logitech, MindPath, or Presentation Electronics. It costs about \$100 and lets you advance or highlight the slides from a distance.
- If multiple notebooks are used for presentations, get a VGA switch box that lets you jump quickly to the second presentation without delay. The best-known vendor is Extron Electronics (800-633-9876, www.extron.com). □



PROJECTIONS
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in a multimedia
projector
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AcerView 76ie	17" (15.7 Viewable Image Size)	1280x1024 @65Hz	iScreen® On-Screen	.27mm
AcerView 56e	15" (13.7 Viewable Image Size)	1280x1024 @62Hz	Digital Control	.28mm
AcerView 54e	15" (13.7 Viewable Image Size)	1024x768 @66Hz	Digital Control	.28mm
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NETWORK EDITION

SMALL-OFFICE NETWORKS

Small Offices Grow Up

Network hardware for the small office is here. But does it provide the scalability and ease of use small offices need?



By Steve Rigney

Once upon a time, a small-office network consisted of a handful of network adapter-equipped PCs connected via coaxial cable. For the past few years, however, the small-office networking market has been booming. According to IDC/Link, a market research firm located in New York City, the percentage of businesses with fewer than 100 employees that have installed networks increased from 18 percent to 23 percent from 1995 to 1996. IDC/Link predicts a significantly greater increase for 1997. In response, network hardware vendors have developed lines of products that bring the power and scalability that larger networks have come to expect to the small-office user

ILLUSTRATION BY KURT VARGO

INSIDE



Small offices are finding out what big offices have known for a long time: Sharing resources is an efficient way of doing business. Even many home-office users who have purchased second and third PCs are looking for ways to connect them. And just about everyone who hasn't yet done so is looking for ways to connect to the Internet.

EASE OF USE and affordable pricing are the primary requirements of most small offices when it comes to choosing network hardware. But how much connectivity and power do you have to give up to meet these needs? Contributing editor Steve Rigney put small-office networking product lines from D-Link Systems, Netgear, and 3Com Corp. through their paces to find out.

THE ANSWER? It depends. Different types of small offices need different types of features. So Steve created a rating for each product based on its suitability for a home office, small business, and branch office. You can read about his findings in this Network Edition cover story.

ONE-STOP SHOPPING has definite advantages. But if all you need is an inexpensive switch for high-bandwidth small-office connections, check out First Looks for Steve Rigney's reviews of the DaynaStar Miniswitch-8 and Matrox's Piranha Switch 8. (Page NE19.)

ISDN IS ONE OF THE MOST POPULAR ways for small offices to connect to central offices or the Internet. In First Looks, project leader Jeffrey Witt examines Ascend's NetWarp 128 ISA ISDN adapter. (Page NE20.)

THE 56-KBPS MODEM phenomenon is senior networking editor Frank Derfler's topic in Multiple Access. (Page NE22.)

—Leon Erlanger

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Intel LANdesk Client Manager
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Editors' Choice

• 3Com OfficeConnect



We had a particularly tough time coming up with an Editors' Choice for this feature. All three product lines offer a nice range of products that

were easy to install. But no single line proved to be ideal for every type of small office. In the end, however, 3Com Corp.'s OfficeConnect came the closest. OfficeConnect offers a complete line of managed and unmanaged hubs and switches as well as an ISDN router for Internet or central-office connections, and print, fax, and CD-ROM servers. All OfficeConnect products have the same small footprint, allowing you to stack them in a corner or on your desk,

and all come with similarly designed documentation geared to the novice. Unfortunately, free technical support is available only for one incident per product, after which 3Com charges \$3 an hour.

Growing small businesses should also take a look at Netgear, which lacks peripheral servers but offers the best scalability of the three product lines. And home-office users should consider D-Link Systems' D-LinkOffice for its free technical support, which is available until 9 P.M., Monday through Friday.

in affordable, easy-to-install packages. Anyone setting up a home- or small-office network can now choose among a variety of products, including managed and unmanaged Ethernet and Fast Ethernet hubs and switches, print servers, and small-office routers.

In this feature we look at families of small-office network solutions from D-Link Systems, Netgear—a Bay Networks company—and 3Com Corp. All these products are designed for networks that range from 2 to 50 nodes. D-Link Systems' D-LinkOffice, Netgear's Netgear, and 3Com Corp.'s OfficeConnect all offer the small-business user 10- and 100-Mbps Ethernet hubs and switches. OfficeConnect goes further and offers an ISDN router for shared Internet or corporate-office connections, along with print, fax, and CD-ROM servers. D-LinkOffice offers an ISDN router and print server. In our First Looks section, we review individual small-office Ethernet switch products from Dayna Communications and Matrox Electronic Systems.

Netgear and 3Com package all products in their lines in similarly designed boxes and provide documentation geared to the novice. Both vendors' manuals are filled with detailed diagrams, showing how you can use the products together. In contrast, D-LinkOffice products lack uniformity. But D-LinkOffice's documentation, while not as colorful as the others', was perfectly adequate.

You can purchase most of these hubs,

switches, and other products we tested separately from mail-order companies, superstores, or authorized resellers. OfficeConnect offers a kit consisting of one eight-port hub, three 10/100-Mbps Ethernet III ISA network interface cards, and three 50-foot twisted-pair cables. You can also purchase OfficeConnect products through Dell Computer Corp.

On our tests, we evaluated each family as a solution for three common small-office types: the home office, the small-business office, and the small branch office of a larger corporation. Though these markets are alike in many ways, they each have specific needs.

AND THE WINNER IS...

With their low per-port prices, tiny footprints, numerous options, and free technical support, D-LinkOffice products make an excellent bet for the home office, despite their lack of consistent packaging. 3Com's OfficeConnect comes in a close second. Small offices will benefit the most from Netgear's scalability, performance, and low-cost entry point. In case you outgrow the Netgear line, Bay Networks offers many options to connect even the largest enterprise networks.

When it comes to products for branch offices, the lines from D-Link and 3Com are about equal. Both provide management software as well as ISDN routers and small device servers. All in all, though, you should probably stick with the vendor that supplies your central-office network.

OfficeConnect comes closest to being

a satisfactory solution for all three types of offices, which is why we gave it an Editors' Choice award.

HOME-OFFICE NEEDS

In considering suitability for home offices we looked for network hardware that was compact, since most home offices are in spaces smaller than business offices. Most home offices are also limited in funds, so we looked for low per-port pricing. We also examined each product line for ease of installation and gave some weight to the availability of free technical support.

If space is your primary concern, you should choose between D-LinkOffice and OfficeConnect. The D-LinkOffice Hubby, a 10-Mbps hub, is the smallest of the pack and fits anywhere on your desk. You can even use your keyboard cable to provide power to the device. D-Link's products also had low prices per port and were generally compact and easy to install. All products in the OfficeConnect line are the same, small size and can stack together to fit on your desktop or in the corner. By contrast, Netgear products come in a variety of shapes and sizes, and they are mountable, but not many users want to mount devices on their home-office walls.

All three vendors offer eight-port 100-Mbps hubs for prices starting in the neighborhood of \$100 per port. While D-Link and Netgear provide free technical support for the lives of their products, 3Com provides free technical support for only one incident per product.

SMALL BUSINESS

Of the three categories, small businesses have the most potential for growth and the greatest need for a wide range of products. The OfficeConnect family offers the widest range of products, but they are not very scalable. For example, you cannot avoid adding another repeater to your LAN by stacking the hubs or switches. OfficeConnect offers only a five-port 100-Mbps Ethernet switch, and the largest hub it provides is a nonstackable eight-port model.

Netgear does a better job for the growing small business by letting you stack its 100-Mbps hubs and offering a seven-port 10/100-Mbps Ethernet switch. Netgear Ethernet switches also work with both 10- and 100-Mbps connections, leaving room to increase throughput as you grow.

As small businesses grow, the need for peripheral servers for fax, print, and CD-ROM sharing also increases. OfficeConnect excels in this area and also

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Features	Oracle7	Microsoft SQL Server
Runs from Laptop to Data Center	YES	NO
WebServer/Database Integration	YES	NO
Cluster Support (Fault Tolerant Parallel Server)	YES	NO
Multiprocessor Scalability	From 1 to 400+ processors	From 1 to 8 processors
Parallel Query, Load, Index	YES	NO
Star Queries	YES	NO
Bitmap Indexes	YES	NO
Integrated Replication	YES	NO
Row-level Locking	YES	NO
OLAP/Multidimensional Integration	YES	NO
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Spatial Data	YES	NO

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offers the best ISDN dial-up router we reviewed. D-LinkOffice includes a well-designed print server, but its ISDN product is complicated to install.

BRANCH OFFICE

Like home offices, branch offices are less likely to grow than small businesses. Instead, since most branch offices don't have their own MIS staff, the most important feature a branch-office device can offer is management from a remote location. D-LinkOffice offers good management for its Ethernet switches, but only OfficeConnect provides a managed 10-Mbps hub. Unfortunately neither vendor provides management for its Fast Ethernet hubs. This means that a remote administrator may have to make a trip to a branch office if something goes wrong with the Fast Ethernet hubs. In addition to the proprietary management software the vendors bundle, the D-LinkOffice switch also includes an SNMP MIB that you can manage from most enterprise-management consoles, such as HP OpenView. Netgear products are not manageable and do not include peripheral servers, another important component for branch-office networks.

The small-office network has arrived. If you've been thinking of linking your home- or small-office PCs, read on.

D-Link Systems Inc.

D-LinkOffice

You'll find a large selection of products in the D-LinkOffice line, including three Ethernet switches, three Ethernet hubs, one Fast Ethernet hub, an ISDN router, and two print servers. All these devices—except the ISDN router—were easy to install and use. But unlike the products in the Netgear and OfficeConnect lines, D-Link Office products lack a consistent look and feel, though documentation is adequate. With powerful utilities for remote switch management and low per-port prices, D-Link Office is best suited to home and branch offices; lack of stackability makes the product line less than desirable for the small office.

For those who need a lot of bandwidth, the most powerful offerings from D-Link are its Ethernet switches. The DES-3205 FlexSwitch (\$2,595) comes with five ports that can switch automatically between 10 Mbps and 100 Mbps and one expansion port that can hold D-Link's ISDN router module (\$1,195), a dual-port Fast Ethernet hub module (\$995), or an 8-port 10-Mbps hub module (\$995). The DES-3205 is a good choice for networks that plan to grow.

The DES-3205 has two smaller siblings:

the \$1,995 DES-2208 ProFast II Switch, which has six 10-Mbps ports and two expansion slots that can each take two 10Base-T, 100Base-TX, 100Base-T4, or 100Base-FX ports; and the \$995 DES-2205 ProFast Switch, with four 10-Mbps ports and a single 100-Mbps port but no expansion slots.

A remote administrator can manage the DES-3205 switch by using the included Office Management software or the optional \$595 D-View software. Or with any SNMP-based management console,

you can manage any or all of the D-LinkOffice switch products. Office Management and D-View provide a graphical interface that lets the administrator monitor device errors and network traffic.

D-LinkOffice hubs aren't manageable nor are they stackable, and—with one exception—they lack AUI and BNC connectors. But with their low per-port cost (as little as \$16 apiece), they should fill the requirement for small home networks and workgroups. In case you need a lot of bandwidth, D-Link's flagship DFE-808TX ProFast (\$995) provides eight 100-Mbps ports and a single uplink port you can use to attach another hub. For those who don't need 100-Mbps performance, there's the DE809TC and DE809TP Ethernet hubs (\$129 each), each with eight ports. The DE809TC provides an extra BNC connection, and the DE809TP comes with an extra 10Base-T connector for daisy-chaining devices. For those who need something small, D-Link offers a

SUITABILITY TO TASK

D-LinkOffice

Home office	Excellent
Small business	Fair
Branch office	Good

Small-Office Network Families



	■ YES ■ NO			
Products listed in alphabetical order		D-Link Systems Inc. D-LinkOffice	Netgear Inc. Netgear	3Com Corp. OfficeConnect
10Base-T hubs		5-port unmanaged, \$39; 8-port unmanaged, \$129	4-port unmanaged, \$39; 8-port unmanaged, \$139; 16-port unmanaged, \$269	4-port unmanaged, \$30; 8-port unmanaged, \$145; 8-port managed, \$475
100Base-T hubs		8-port unmanaged, \$995	8-port unmanaged, \$995; 16-port unmanaged, \$1,650	8-port unmanaged, \$850
Ethernet switches		5-port managed ¹ , \$995; 6-port 10-Mbps managed, \$1,995; 5- port 10/100-Mbps managed, \$2,595	2-port 10/100-Mbps unmanaged ² , \$650; 7-port 10/100-Mbps unmanaged ² , \$1,290	5-port unmanaged ¹ , \$1,185
Other hardware		ISDN router, \$1,795; print server, \$395	None	ISDN router, \$1,495; CD-ROM server, \$795; fax server, \$1,695; print server, \$399
SUPPORT				
Free technical support	■	■	■ (first incident only)	
Hours of operation (eastern)	10:00–9:00, M–F	24 hours, 7 days	9:00–8:00 M–F	
Technical-support phone number	714-455-1688	800-211-2069	800-876-3266	
Web address	www.dlink.com	netgear baynetworks.com	www.3com.com	

(1) This product has four 10-Mbps ports and one 100-Mbps port. (2) This product has only one 10/100 port; the other ports are 10-Mbps.



D-Link Systems rounds out its line of hubs and switches with an ISDN router (top) and a print server (bottom).

five-port Ethernet hub, the Hubby (\$99).

The DI-1135 ISDN router (\$1,795) comes in a large chassis and has one BRI line. It lacks ports for analog telephones and faxes, and because of its merely adequate documentation and the large number of disks that have to be loaded it's

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more difficult to set up than the Office-Connect 530. The DE960, a NetWare print server, and the DE970, a Windows NT server (\$395 each), are easy to set up, and each can support three printers, which connect to two parallel and a single serial port. **D-LinkOffice.** D-Link Systems Inc., Irvine, CA; 800-326-1688, 714-455-1688; fax, 714-455-2521; www.dlink.com. Circle 955 on reader service card.

Netgear Inc., A Bay Networks Company

Netgear

Product offerings from Netgear are not as extensive as those of the other two small-office lines we tested, and none of the devices are manageable. But low per-port pricing, free 24-hour, 7-day technical support, and multiple port configurations make Netgear a decent solution for both the home office and the small office. Branch offices will probably want to look at manageable solutions from D-Link and 3Com. The Netgear family includes the EN

series of 10Base-T hubs, the SW series of 10/100-Mbps switches, and the FE series of stackable 100Base-T hubs. If you're looking for connectivity to either an Internet service provider or a central corporate office, Bay Networks plans to add the RT211



Stand by Me: Netgear provides novice users with 24-hour, 7-day technical support.

ISDN router to its line; it should be available in the second quarter of 1997.

Each Netgear product is sold separately, and with the exception of one green hub, they all come in midnight-blue chassis. Each product also comes with a mounting kit and excellent documentation, with detailed diagrams geared to the novice. The 24-hour, 7-day-a-week technical support is particularly useful for home-office users. Netgear products do not, however, come with the same footprint, as do products in the Office-Connect line.

The EN 10Base-T hubs are available in various configurations. There are a 4-port (\$99), an 8-port (\$149 with an internal power supply; \$139 with an external-power adapter), and 16-port (\$289 for a rack-mountable unit with an internal power supply, \$269 with an

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external-power adapter) configurations. The 4-port hub lacks an AUI connector, but each of the products comes with a BNC connector and an uplink port, which lets you connect multiple hubs using standard 10Base-T cable.

These 10Base-T hubs aren't stackable, but you can daisy-chain as many as four of them on a single network segment. LEDs located on the front of the chassis provide connection and collision information.

For more bandwidth-hungry operations, Netgear offers 8-port (\$995) and 16-port (\$1,650) Fast Ethernet hubs. Unlike the 10-Mbps offerings, the Fast Ethernet hubs are stackable up to four units. These ports support only Fast Ethernet, however, not 10-Mbps Ethernet, making a gradual upgrade from 10-Mbps to 100-Mbps Ethernet difficult and potentially expensive.

Offices with high bandwidth needs will also be interested in Netgear's two- and seven-port 10/100-Mbps Ethernet switch-

SUITABILITY TO TASK

Netgear

Home office	Good
Small business	Excellent
Branch office	Fair

Netgear. Netgear Inc., A Bay Networks Company, Santa Clara, CA; 510-490-4774; fax, 408-495-3397; netgear.baynetworks.com. Circle 956 on reader service card.

3Com Corp

OfficeConnect



Even though some of its components are manufactured by Castelle, of these three product families the OfficeConnect family, from 3Com Corp., provides the best continuity across its product line. All OfficeConnect products—which include managed and unmanaged Ethernet and Fast Ethernet hubs, an

unmanaged switch, and CD-ROM, fax, and print servers—share the same small footprint, so you can stack them on the same desktop. And all the products come with novice-friendly documentation, with excellent diagrams. Unfortunately, scalability is limited, making OfficeConnect best for branch offices, and technical support is limited to one free call per product; after that, 3Com charges \$3 per hour.

Of the various Ethernet hubs in the OfficeConnect family, the most powerful one is the 8/TPM, a managed eight-port hub (\$475). It comes with a scaled-down version of 3Com's Enterprise Manager, which is called Transcend Quick Configuration Manager and may be all you need for a small network. Like D-Link's D-View software, Configuration Manager provides charts and graphs of your network traffic. The OfficeConnect family also includes the 8/TP, an unmanaged eight-port hub (\$145 for twisted-pair; \$185 for twisted-pair and BNC) and two four-port hubs, one with an auto-sensing



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The family. The DIVA family offers a complete range from ISA and PCI to PC-Cards, including DIVA 2.0, a low-cost passive interface card for Internet access; and DIVA Pro 2.0, which includes support for fax and analog modem communications for professional Internet/intranet users. The DIVA family of products includes versions with built-in NT1 (U-interface) and supports MultiLink PPP. The S/T version works worldwide and supports North American PBX systems. Drivers for DOS, OS/2, or UNIX are available on request. DIVA ISDN interface cards are certified for EZ-ISDN 1.

*10-minute installation assumes running Windows 95 and using Eicon's ISDN line ordering service. The ISDN line must be installed and functional at installation.
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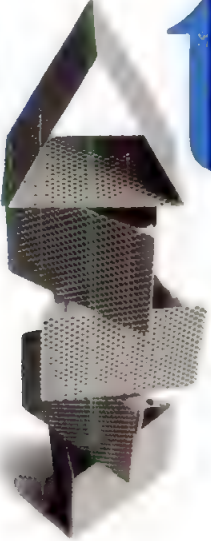
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COVER STORY



Though OfficeConnect products aren't stackable in the classical networking sense, you can stack them to save space.

BNC/AUI port (\$125) and one without (\$90). Like other OfficeConnect products, OfficeConnect hubs are not stackable, but you can daisy-chain as many as four units on one network segment.

The next step up in performance in the OfficeConnect line is the 8/TP100, an unmanaged hub (\$850), which has eight 100-

Mbps Ethernet ports. Like the 8/TPM, it includes an uplink port for daisy-chaining multiple units, but there are no AUI or BNC connectors. The Switch 140 (\$1,185) provides four 10-Mbps and a single 100-Mbps port that can serve as an uplink connection.

The \$399 print server, developed by Castelle, provides two parallel ports and works with NetWare-, Windows NT-, EtherTalk-, and Unix-based networks. It includes easy configuration software for each.

For connections to the Internet or a central office, the \$1,495 OfficeConnect Remote 530 includes two 64K ISDN B-channels and works with all of the major protocols including PPP, Multilink PPP, and 3Com's proprietary Fast Connect Protocol. The 530 is extremely easy to set up and use.

Though not useful for all small networks, the \$1,695 fax and \$795 CD-ROM servers round out the Office-

Connect family. The fax server works with both Windows NT and NetWare networks and includes client software for 50 DOS and Windows users. The fax server also includes a parallel port for automatic printing of received faxes; you can also send faxes to any network

printer. The only complicated configuration task is figuring out how to route incoming faxes. But fortunately the product includes detailed documentation to help you through this process.

The CD-ROM server can handle as many as seven CD-ROMs, and it works with any TCP/IP- or IPX-based network. The server comes with management software that lets you assign user rights to CD-ROM servers and even to individual CD-ROM titles. □

OfficeConnect. 3Com Corp., Santa Clara, CA; 800-638-3266, 408-764-5000; fax, 408-764-5001; www.3com.com. Circle 957 on reader service card.

SUITABILITY TO TASK

OfficeConnect

Home office	Good
Small business	Good
Branch office	Excellent

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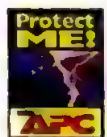
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

SMALL-OFFICE SWITCHES

Switching for the Masses

By Steve Rigney

In this issue's Network Edition Cover Story, we look at three families of connectivity solutions for both the small office/home office and branch office environments. These families all include 10-Mbps Ethernet hubs and switches—some of the lines offer 100-Mbps solutions—plus print, fax, and CD-ROM servers. Although buying all your network components from a single vendor is usually a good idea, at times you may find a better standalone solution from a third party. Good examples of this are the DaynaStar MiniSwitch-8, from Dayna Communications, and the Piranha Switch 8, from Matrox Electronic Systems, two 10-Mbps Ethernet switches with eight ports each.

With reduced prices per port (the Piranha is only \$499) and smaller form factors, Ethernet switches such as these two are finding their way into many small networks. Fast throughput is no longer just for large networks; even home offices may need the guaranteed throughput a switch provides.

Dayna Communications Inc.

DaynaStar MiniSwitch-8

With a design reminiscent of a desktop modem rather than an eight-port 10-Mbps Ethernet switch, the DaynaStar MiniSwitch-8, from Dayna Communications, should meet the needs of most small offices. Though at \$995, it isn't as inexpensive as the Piranha, it does

offer features that the Piranha does not. For example, in addition to the eight 10-Mbps ports, the MiniSwitch-8 has an uplink switch and a BNC connector. It also has extensive documentation that tells you how to do such things as segment your

provide every user with an individual switched port. This means you have to decide how to segment your network and which PCs require a port on the switch. The MiniSwitch-8 documentation provides diagrams that show you how to connect



Switching Star: The MiniSwitch-8 provides excellent documentation, particularly for segmenting your network.

network. Like the Piranha, it doesn't have management software, but in a small office you may not need any.

Though small enough to sit on the most cluttered desktop, the MiniSwitch-8 includes a mounting kit, so you can attach the device to either a wall or your desk. Another thoughtful design element is the inclusion of LEDs for each of the ports; with them, you can tell if ports are in use and if they're receiving any traffic.

An Ethernet switch is designed to segment workgroups or provide guaranteed bandwidth to a file server or high-traffic client PC. Because per-port prices for switches are usually higher than with a basic hub, you may not be able to

multiple switches without wasting a switched port or using a 10Base-T crossover cable. But you can connect only a total of four 10-Mbps switches to a single network cable segment. The MiniSwitch-8 provides a BNC connector that you can use to connect your switch to an existing coaxial backbone, and you can even use a piece of coaxial cable to daisy-chain four switches, though you can't use the BNC and the uplink port at the same time.

DaynaStar MiniSwitch-8. List price: \$995. Dayna Communications Inc., Salt Lake City, UT; 801-269-7200; fax, 801-269-7363; www.dayna.com. Circle 951 on reader service card.

Matrox Electronic Systems Ltd.

Piranha Switch 8

At \$499 for eight 10-Mbps ports, the Piranha Switch 8, from Matrox Electronic Systems, is the least expensive switch on the market, as far as we know. This product is a good solution for a small network. It doesn't, however, have management capabilities, nor does it offer an uplink connector, or extra AUI or BNC connectors. This makes it a poor choice if you need a switch you can add to an existing network or workgroup. And though it's easy to install, we found that the product's sparse documentation makes configuration changes challenging, particularly if you're a novice.

Housed in a small box-like chassis approximately the size of Dayna Communications' DaynaStar MiniSwitch-8, the Piranha weighs only about a pound, and it's small enough to fit on your desktop. Its edges aren't smooth, though, and it doesn't have a mounting kit, so

CROSSTALK



Leon Erlanger

“ Frank, you would use one of these small switches in front of one or two file servers, each with its own dedicated 10-Mbps port, and then attach small hubs with a few nodes to the other switched ports. That provides local segmentation with enhanced access to commonly used servers. But would you ever use one of these switches alone on a small LAN? ”

“ Yes. And these little switches can solve other problems too, Leon. In any environment where the nodes generate steady streams of traffic among several different nodes (for example, in a LAN that carries a lot of print jobs to several networked printers), these low-cost switches would be really valuable. ”



Frank Derfler

you can't attach it to the wall or anywhere else.

Like most unmanaged switches, the Piranha installation is plug-and-play. The manual consists of a double-sided three-page chart that explains only the basics and provides a simple diagram. Unlike the MiniSwitch-8 manual, the Piranha documentation doesn't provide information on segmenting your network, nor does it define key networking terms.

Though the Piranha guide could be improved, that isn't the biggest problem. Both the

MiniSwitch-8 and the Piranha work with 10-Mbps half-duplex and 20-Mbps full-duplex connections. But the MiniSwitch-8 can change connection types automatically, whereas the Piranha requires that you change dip switches for each port to switch between half- and full-duplex modes. In addition, the dip switches are located inside the case, which means you have to take the cover off to make the change. To make matters worse, the dip switches don't use the same numbering scheme as the ports. Repre-

sentatives at Matrox told us that these shortcomings have been remedied in units now shipping.

The Piranha is a store-and-forward switch that can store a total of 8,192 Ethernet addresses. When you first turn on the Piranha, it looks for all the existing Ethernet addresses and stores them in a table. Each time you add a new device, the Piranha captures its address and stores it for future reference. To speed up performance, the switch also contains a 1MB packet buffer that can cache or store network packets in memory.

Unlike the MiniSwitch-8, the Piranha doesn't offer extra connectors or an uplink connection. If you want to daisy-chain multiple switches, you have to use one of your



Shark Switch: The Piranha comes in at \$499.

switched connections. The Piranha offers a single LED for each port, which lets you know if the port is in use but doesn't provide the activity information that LEDs on the MiniSwitch-8 do.

Piranha Switch 8. List price: \$499. Matrox Electronic Systems Ltd., Dorval, Quebec, Canada; 514-685-2630; fax, 514-969-6272; www.matrox.com. Circle 952 on reader service card.

ISDN TERMINAL ADAPTERS

Ascend's NetWarp Factor

By Jeffrey G. Witt

Though better known for its high-end networking products—those geared towards corporate sites, carriers, and ISPs—Ascend Communications is now fishing for your Microsoft Windows desktop

with its NetWarp 128 ISA ISDN (\$229). The NetWarp is a half-size internal adapter with no jumpers or switches, and it sports a 16-bit ISA bus interface. This product is ideal for small offices or individual users who want ISDN access to the Internet or remote access to their company networks. It's also useful for sites looking to build an ISDN-based Windows NT server environment, because you can put the NetWarp in a Windows NT server and run RAS.

The NetWarp's plug-and-play capabilities make installation uneventful; our HP Vectra 5/90C Windows 95 test machine immediately recognized the adapter and called for the appropriate software driver. But you also need Windows 95's Dial-Up Networking, a TCP/IP stack, and the ISDN Accelerator Pack 1.1 for Windows 95 to install the product. Similar to the way you configure a network adapter, you configure NetWarp by using driver software provided by

PERFORMANCE TESTS

ISDN Adapters



For our throughput tests, we established an FTP session to transfer two file types: a noncompressible random file (with a compression ratio of 1:1.1) and a moderately compressible text file (with a compression ratio of 2.5:1). We ran the tests over single and dual B-channels between a Windows 95 client and a Windows NT 3.51 server running Internet Information's FTP Server. We

used national ISDN-1 lines to connect the Ascend NetWarp 128 to our Ascend MAX 1800 ISDN router with MPPC compression enabled. For comparison, we performed the same file-transfer tests with a PC Magazine Editors' Choice winner, the Diamond Supra NetCommander ISDN ("Digital Dragsters," February 4, 1997), and with a 28-Kbps modem, the U.S. Robotics Courier V. Everything,

	Throughput—one B-channel		Throughput—two B-channels	
	Kilobits per second		Kilobits per second	
Ascend NetWarp 128	58.9	152.4	113.8	258.6
Diamond Supra NetCommander ISDN*	59.2	152.4	120.5	281.3
Standard 28.8-Kbps modem*	24.8	66.7	24.8	66.7

*Reported for comparison

BETTER ►

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to the desktop
sounds great.

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need 11 Mbps,
that is.

SMC TigerStack 100 Fast Ethernet stackable hubs.

Let's face facts. A few users simultaneously accessing standard office applications can drain all the bandwidth in a 10 Mbps network. Combine that with today's client/server, Internet access, and imaging applications, and 10 Mbps to the desktop won't hold water for very long.

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And with multi-segment management (SNMP and RMON), as well as the industry's strongest Customer Satisfaction Guarantee, the TigerStack 100 offers all the reliability you need. Not to mention a per-port price that's easy to swallow.

So if you're looking for a bandwidth solution with capacity for the future, look to the TigerStack 100 from SMC. We think you'll find our Fast Ethernet strategy watertight.



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Ascend for Windows 3.x, Windows 95, and Windows NT environments.

Because of its auto-sensing feature, the NetWarp removes the guesswork from determining your ISDN switch type. For the remaining setup, you follow Microsoft's ISDN Wizard to enter your line's Service Profile Identification (SPID) numbers and calling profiles. We'd like to see such future enhancements as auto-detection of the SPIDs as in other vendors' products.

Included with the NetWarp is an easy-to-understand Quick-start Guide, the Accelerator Pack, and Microsoft's Web browser, Internet Explorer. You also get NetManage's Chameleon Web Kit software bundle, which provides Windows 3.x desktops with a TCP/IP stack and Web brows-

NetWarp's auto-sensing helps you easily determine your ISDN switch type.

er. In addition, the NetWarp comes with an excellent diagnostics utility, the virtual LED, which is handy for troubleshooting during setup and for checking status.

The NetWarp offers two 64-Kbps ISDN B-channels. We placed calls over a single line and—using the Accelerator Pack's Multilink PPP capability—over both lines for 128-

Kbps connections. We executed FTP file transfers on one and two B-channels with two file types to measure performance. Our noncompressible-file test represents typical Web traffic and the moderately compressible file a common word processing document. When we compared our results with those of a call made with a 28.8-Kbps modem, we found that with a single B-channel the NetWarp's throughput was double that of the modem, and with both B-channels the NetWarp was more than four times as fast. The NetWarp also held its own against our recent Editors' Choice winner, the Diamond Supra NetCommander ISDN (\$249) ("Digital Dragsters," February 4, 1997).

The NetWarp supports both the built-in Windows 95

(MPPC) and the Hifi compression schemes. Both types are supported in Ascend's backend products as well; check with your ISP or LAN administrator to determine which scheme to use.

Though the NetWarp has many positives, its main drawbacks are its lack of connectivity and management bells and whistles. The NetWarp doesn't have an analog port, which Ascend's NetCommander does have. You also won't find advanced management features, such as the NetCommander's ability to add another B-channel dynamically.

NetWarp 128 ISA ISDN. List price: \$229. Ascend Communications Inc., San Jose, CA; 800-621-9578; www.ascend.com. Circle 953 on reader service card.

MULTIPLE ACCESS By Frank J. Derfler, Jr.

56-Kbps Modems—Ha!



Judging from the levels of PR heat and light, 56-Kbps modems (Ha!) are about to descend to earth. Should you stand on a hilltop and open your arms wide or hide in the basement? I think you'll eventually embrace these things, but first you need to sift through the PR for the truth. Like aliens that

Scully and Mulder encounter from time to time on "The X-Files," these modems come from a couple of different gene pools, but they all look very much alike.

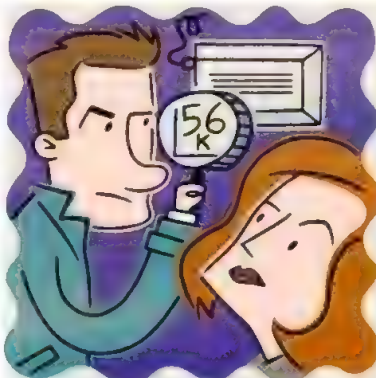
Since you're a sophisticated Network Edition reader, you know that 56-Kbps modems won't work point-to-point at high speeds and that for them to work your corporate LAN access server or ISP must have a digital connection to the telephone company. You know that the high-speed channel is for download only and that upload is at regular modem speeds. Finally, you know that a real standard is a year away, that Rockwell and U.S. Robotics are morphing different technologies, and that Lucent cheers for Rockwell.

Now, let's blow away some smoke. Whether they come from U.S. Robotics or from the clusters of product makers working with either Lucent or Rockwell, 56-Kbps modems probably won't make 56-Kbps connections anytime soon. Hence my "ha!" Rockwell and U.S. Robotics both admit that

they have a problem staying within FCC guidelines for the amount of power these devices can pump into the phone line at specific audio frequencies. The straight-talking deputy directors at these companies admit that even when they test at audio levels that would prevent FCC certification, typical connection speeds are only in the 40- to 50-Kbps range. These folks talk about getting the FCC's rules changed, but the telcos will fight change every inch of the way. Staying within the rules limits the theoretical top end to about 50 Kbps.

A Scully rationalist would point out that 56-Kbps modems are much cheaper than ISDN and practically as good for Web surfing or LAN access. On your own system, you must balance your modem choice by looking at the vendor selected by your ISP and the one selected by the company that made your remote-access server. Maybe this means changing ISPs or buying two modems, but you won't have much choice. If you have corporate responsibilities for remote access, you need a survey to see how many and what types of upgradable modems your callers own.

A Mulder romantic would hate the anxiety he'd have to go through over whether to upgrade his corporate or personal modems or buy new ones with a promised upgrade path. Each vendor of end products based on Rockwell or Lucent chips, such as Cardinal, Hayes, Zoom, and dozens of others, will have a different story about the upgrade options for existing products. Generally, the more you originally paid, the less you'll pay to upgrade. You'll have to check Web sites to get information on the upgrade options from vendors, but expect them to price upgrades so that the decision to buy or upgrade is a close call.



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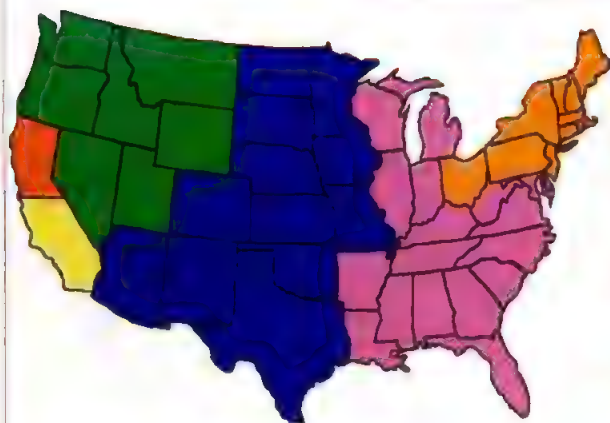
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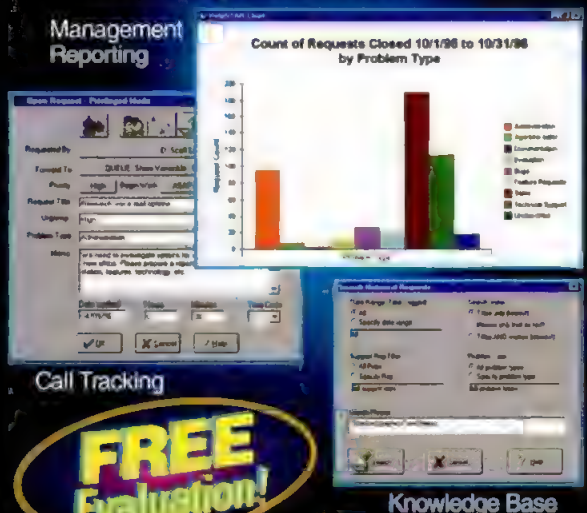
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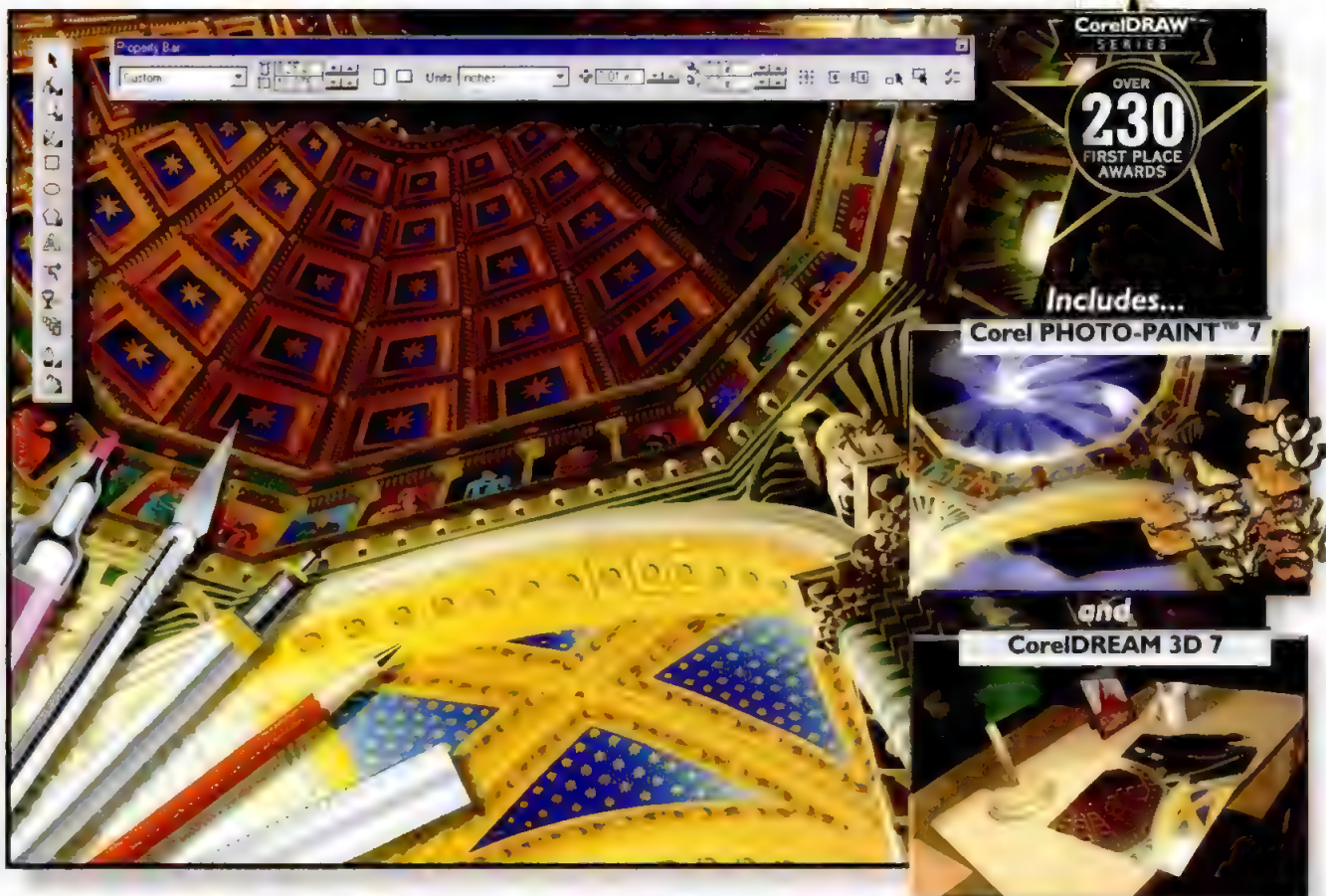
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WORKSTATION

By David S. Linthicum

AS INTEL'S PENTIUM PRO ENCROACHES ON WORKSTATION SPACE, RISC VENDORS ARE COUNTERING WITH MORE AFFORDABLE SOLUTIONS. PC MAGAZINE LABS TESTS SEVEN GRAPHICAL WORKSTATIONS RUNNING POPULAR ENGINEERING AND GRAPHICS APPS.

WARS



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these workstations'
performance results
.....

To drive a nail, you need a hammer. To drive a high-end graphics application, you need a graphical or engineering workstation. But which one? Which platform? Which generation?

Once graphical workstations were the exclusive domain of the top-of-the-line Unix workstation vendors. Today we have new choices with the advent of muscle-bound Pentium Pro-enabled PCs and new peripheral devices such as

3-D accelerators and graphics co-processors. High-end workstation vendors such as Silicon Graphics Inc. (SGI) and Sun Microsystems are responding by building scaled-down versions of their workstations that place them in the same price range (well, almost the same) as the high-end x86 workstations.

Selecting the right workstation requires forethought before plunking down the big bucks on one of these beasts. Put your money in the wrong place and you could find you have a proprietary monster that runs nothing more than niche applications. Or you could find yourself with a box that does not scale to meet new application-processing requirements.

THE BIG PICTURE

Graphical workstations are computers that support those high-resolution graphical applications that eat CPUs and graphics chip sets for lunch. These specialized applications include CAD/CAM (computer-aided design/computer-aided manufacturing), data visualization, computer-aided software engineering (CASE), and almost *Jurassic Park*-like animation. Most of these apps make use of 3-D graphics and thus need the hardware to handle them.

In years past, PCs did not make good graphical workstations. Instead, Unix workstations such as those from Digital Equipment Corp., Hewlett-Packard Co., SGI, and Sun ruled the graphics universe. Each of these workstations ran a proprietary flavor of Unix, and all cost five to seven times what we paid for PCs at the time. Although PCs could perform fundamental graphics tasks, they did not have the resolution or the performance for the high-end stuff. And in many cases, high-end graphics software, such as engineering packages, wasn't ported to the PC.

Things changed quickly. As PCs grew in popularity, the performance and functionality gap between the PC and the workstation narrowed. Since a PC is functionally just a set of components, vendors learned how to retrofit the technology that was driving the high-end graphical workstations of the day. Processors, of course, increased in power. What's more, PCs became multiprocessing powerhouses employing operating systems such as Windows NT to exploit this newfound

power. It's safe to say that PCs viewed existing graphical workstation technology as an objective, not a competitor. While high-end workstations still provide better graphics performance for the most part, PCs are catching up quickly.

While PCs are working their way up to workstation-class performance, however, workstation vendors are working down. Because PCs provide the best cost/performance ratio, they have been taking market share away from workstations. To counter, workstation vendors are providing less expensive versions of their products.

WHAT WE LOOKED FOR

To determine which is the best way for intensive graphics applications to go, we took several workstations out for a test drive; the tested machines included the DayStar Genesis MP 800+, the Digital Personal Workstation 433a, the Silicon Graphics O2 Desktop Workstation, the Sun Ultra 1 Creator 3D Model 140E, and the UMAX SuperMac S900/250dp RAID. Both the DayStar and the UMAX are Macintosh compatibles.

To represent the PC world we tested two Pentium Pro-based dual-processor workstations: the Compaq Professional Workstation 5000 and the HP Vectra XW 6/200, both running Microsoft Windows NT 4.0. The filter was liberal. We asked for low-end to midrange graphical workstations ranging in price from \$10,000 to \$15,000. We did not restrict configurations because of the heterogeneity of the platforms.

Our Contributors: DAVID LINTHICUM is a senior manager for AT&T Solutions. DAVID CHERNICOFF is the technical director for *Windows Sources*. DANIEL GROTTA and SALLY WIENER GROTTA are contributing editors of *PC Magazine*. JEFF MACE is the project leader for graphics and hardware at *PC Magazine*. CAROL VENEZIA was the senior associate editor in charge of this story, and NICK STAM, *PC Magazine's* technical director for hardware, was the project leader.

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PLATFORM WARS

So what's it going to be—MIPS, Pentium Pro, PowerPC, or SPARC? How many processors? What about the OS? The processor and operating environments make up the platforms, which, along with the vendors, define performance, scalability, and application software availability.

As the CPU wars rage on, we found, at least on the low end, that the RISC-like Pentium Pro has clearly moved into the territory of the low-end workstation. But Intel has not yet shown all of its cards. The Pentium II, debuting later this year, should yield clock speeds up to 266 MHz initially. With its next P6-class chip (code-named Deschutes) we could see a 300- or 333-MHz x86 shortly. This is certainly not good news for a workstation market that is losing its shirt to x86 machines that, as we found, provide better price/performance.

MIPS and SPARC (the CPUs of choice for SGI and Sun, respectively) offer RISC performance but could not handle our multithreaded application tests as well as x86 or Mac-compatible machines did. Digital's entry was an extremely powerful performer, but other workstations also turned in good numbers. While the Digital machine crunched numbers better on some of the tests, the x86 workstations, turning in decent results, were able to make up for the extra horsepower of Digital's system by leveraging better I/O subsystems on some tests.

Both the O2 and the Ultra 1 were able to keep up and excel on some tests, but the Mac compatibles demonstrated that on some apps, the PowerPC has trouble delivering performance that sets it apart from the others. However, both of our Mac compatibles performed exceedingly well on our MP-enabled Photoshop tests, which shows that if you have the software to support the platform, it makes a world of difference in performance.

Editors' Choice

* Different choices for different needs



Choose the workstation that provides the application software and platform support that fit your requirements.

It's rare that we are presented with a group of incredibly capable, highly powerful, and impressive systems and are unable to award an Editors' Choice. In our roundups of mainstream desktop PCs the competition is stiff, but one or more machines usually stand out as Editors' Choices. In this group of graphical workstations, however, we are presented with a completely different paradigm.

Each of these seven systems—the Pentium Pro-based Compaq and Hewlett-Packard machines, the Macintosh compatibles from DayStar Digital and UMAX Computer, Digital's Alpha-based workstation, Silicon Graphics' MIPS-based system, and Sun Microsystems' UltraSPARC box—is highly respectable in its own right and would well serve your workstation needs. However, the needs of every workstation user are different, particularly in terms of software and platform support, and that is where these machines diverge.

The graphical workstation market demands highly specialized and usually very expensive vertical applications that address the needs of numerous markets, including CAD/CAM, imaging, finite-element analysis, 3-D rendering, and the like. And the fact is, not all of these applications are available across all platforms. Of the ten different applications-based tests that we ran on these machines, not one was available across all platforms. This is why we feel strongly that when buying a workstation, you should choose the one that provides the software support you need.

Either of the two Pentium Pro workstations reviewed here would be a good pick for the Intel/Windows NT platform. Both benefit from the support of two firmly established companies with clear product directions for the future. With the release of the Pentium II processor, this platform will become even more compelling. And on the software side, the number of independent software vendors

(ISVs) developing for the Windows NT platform is growing at a faster rate than virtually any other OS today. Both Pentium Pros were also standout performers on our applications tests, proving that when it comes to horsepower, Intel has a workstation contender in this CPU. But if you need a machine that can perform extremely high-end graphics tasks, there is little available on this platform today; you'll likely have to go the RISC/Unix route.

If Windows NT is your OS but the CPU doesn't need to say "Intel," Digital's Personal Workstation 433a, based on the same vendor's 433-MHz Alpha 21164 processor, is an outstanding machine. Under the applications we tested with native Alpha ports, the Digital box blew away the competition. The challenge for this platform, however, isn't hardware—it's software. Of the ten applications we ran on our test machines, only four were available for the Alpha (we ran two productivity apps in emulation mode under Digital's FX!32). Digital is investing heavily in development for this platform, but the challenge will be in finding the ISVs to support it.

If you prefer Unix, either SGI's O2 Desktop Workstation or Sun's Ultra 1 Creator 3D Model 140E would work well, depending on the apps you need. These systems may have been beaten on many of our apps tests by the Windows NT boxes, but when it comes to graphics and video support, platform growth potential, and high-end software support, these are the machines to beat. If you want to render fully immersive VR worlds or create a film like *Toy Story*, you won't be doing it on a Windows NT machine. On the flip side, both SGI and Sun face a strong challenge from the Intel/Windows NT front at this level: x86 machines simply present a better price/performance picture today than RISC/Unix machines do.

If any platform is in danger over the long term, it's the Macintosh. And it's not from a lack of zealots: Many serious graphics artists contend that there's none better than the Mac. In fact, our art department here at *PC Magazine* runs on Macs. If you choose the Mac, both Mac compatibles here present a compelling case for the platform. They are priced in line with the others, and their performance is generally acceptable (users focusing on apps ported to DayStar's MP API will find they're extremely fast). Workstation users requiring engineering and scientific visualization software, for example, may have a hard time finding the right package on the Mac platform. But many programs for graphic arts, multimedia production, broadcast-quality chroma keying, and medical imaging, among others, are ported to the Mac.

THE OPERATING SYSTEMS

You've got to consider the OS along with the hardware, and our tests ran the gamut. Both the O2 and the Ultra 1 ran flavors of Unix, an OS that's older than most of the programmers who develop on it. Our Ultra 1 ran Solaris, based on Unix SVR4, while the O2 ran IRIX. But although they have Unix in common, these machines can't share binaries, and the look and feel of their interfaces are different.

Although Unix is a robust OS, there are drawbacks aplenty. Only a fraction of applications sold today are available for Unix, although Sun has one of the better application followings, with SGI close behind. You have to consider releases as well. Where you may find the latest and greatest on Wintel, it could take months (years, in

some cases) before you find the same release on Unix. The same holds true for Digital's Alpha machine, which has the worst native software support of all the systems here. For instance, we could get Photoshop 4.x for our x86 and Mac workstations but could find only 3.x for the O2 and the Ultra 1, and a native version wasn't available for the Digital Alpha.

If you're a glutton for punishment, you can run your favorite Windows apps on Unix using a translator such as Wabi, or a PC emulator such as SoftWindows by Insignia Solutions. Wabi can translate Win16 or Win32 calls into native GUI calls (Xlib, for example). While this approach seems simple and provides the best performance, most Windows application won't run with Wabi—in fact, we

couldn't get a few of the applications it does support running at all.

SoftWindows 95 runs Windows 95 under Unix and thus is able to support almost all Win16 and Win32 apps. However, the overhead of an OS running under an OS leaves a high-priced workstation performing about as well as a 486/66. If you need to run more than one or two Windows apps under Unix, you're better off putting a PC next to the workstation.

Although the Digital machine had the worst native software support, the vendor's FX!32 technology provides an acceptable mechanism to run native Wintel apps. FX!32 is not really an emulator but a translation layer allowing native Alpha instruction code to be derived from x86 application instructions. What's more,

FX!32 is able to watch and learn how the application executes, creating native code for the Alpha. Performance is good but reaches only about half the speed of the Pentium Pro systems we tested.

SOFTWARE INSTALLATION NIGHTMARES

Those of you used to the easy installation of applications expected in the Windows and Mac worlds can forget it with Unix. We found that routine software installation takes an incredible amount of time and trouble. What's more, many apps we tested required the use of a license manager that monitors the use of the pricey Unix applications. You have to enter a magic code that allows you to run the application for a certain amount of time. Run out of time and you'll need a new code from the vendor (and it always seems to happen on weekends).

The dependence on license managers drives Unix administrators nuts, since apps expire before they should, and license managers fail. Both mean that you're scrambling to fix a problem caused by some people making darn sure that you show them the money. This is the "dongle" principle from the early days of PC apps. Wall Street trading floors have been shut down because of an expiring license or a license manager failure. On our tests we ran across this problem several times. Obviously, the Unix folks aren't as trusting as the Wintel folks.

GRAPHICS APPLICATION PERFORMANCE

All the systems we tested provide roughly the same resolution and image quality. However, Sun's Ultra 1 provided a more attractive display and top-notch frames-per-second performance (as did the Compaq). SGI's O2 had the best look and feel, with a friendly, easy-to-follow interface. At the other extreme, we did have some trouble with the HP system: It did not support 1,280-by-1,024 24-bit color resolution with certain software.

All the workstations—except the Macs—were 3-D-enabled through either on-board chip sets or add-in cards. The x86 workstations came with 3-D boards installed. For instance, for the Vectra XW, HP selected the AccelGraphics AccelPRO T/2500 3-D graphics adapter using 3Dlabs' Glint 500TX chip set.

When going head to head with the



other Windows NT workstations, Digital's entry is the clear speed demon. While running our AutoCAD test, for example, the Personal Workstation 433a beat the x86 systems by huge margins. We also found when running Microsoft's Softimage that the Personal Workstation 433a crunched numbers better than the others did. But remember, you need native Alpha apps, which are hard to come by.

PIXEL-INTENSIVE APPLICATIONS

To exercise our machines, we selected popular graphics and engineering applications including Adobe PageMaker, Adobe Photoshop, Advanced Visual Systems' AVS/Express, Autodesk's AutoCAD, Microsoft's Softimage 3D Extreme, Parametric Technology Corp.'s Pro/Engineer, and Visual Numerics' PV-Wave. With our eclectic platforms, not all the apps ran on all the systems. For example, Photoshop ran on all the platforms except the Digital, but only the x86 and Mac compatibles could run the latest version.

The test apps were unique because of their requirements for intensive graphics support and special hardware. Softimage 3D Extreme, for example, is a high-end 3-D animation package that provides features such as animation and dynamic simulation, relational modeling, and flexible motion capture. Softimage was the most difficult to install but was able to give the systems it ran on a run for their money. While there are versions of Softimage for x86 workstations, the O2, and the Person-

al Workstation 433a, versions for the Macs and the Ultra 1 are not available.

FUTURE OF THE WORKSTATION

It's difficult to determine a single winner among the systems here; thus we declined to select an Editors' Choice. The issue is really one of determining your requirements and software needs, then matching those up with the proper platform.

A common thread throughout this feature is the tradeoff of price/performance for scalability. The x86 workstations provide the best price/performance, with the best software support of all of the platforms. However, you're not going to have the option of scaling up to a much larger system when the need arises. While HP does have a line of more powerful workstations, they are Unix-based and not binary-compatible with the x86. By contrast, the Personal Workstation 433a, the O2, and the Ultra 1 all have larger cousins. Sun workstations, for example, can take your apps to a 14-processor monster, with a \$100,000 price tag to match.

As the PC becomes more powerful, the high-end workstation and server vendors (such as Digital, SGI, and Sun) may not be able to produce low-cost machines any more. The birth of the next-generation Intel CPU could be the knockout punch.

IS managers are already following this trend. Some Wall Street firms, for instance, are moving traders who once hovered around Unix workstations to high-end PCs. PCs are there anyway to run office automation apps, so why not use them to run the graphically intense software as well? Where there once were Unix workstations on the trading floors as far as the eye could see, PCs now take up the space. The same is happening in the engineering world, where power and graphics are everything. However, specialized users such as high-definition animation artists aren't willing to part with their mega-workstations just yet.

For now, you need to drive your workstation selection with some common sense. In most instances, x86 machines will work just fine for most general-purpose, high-end graphics apps. They are cheaper and application-rich, and they perform well. There's really no need to look beyond the x86 workstations unless the non-x86 ones support a feature or an application you must have.

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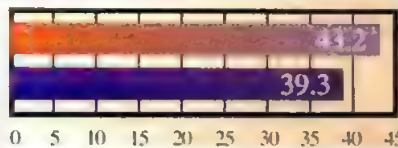
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Business Winstone '97
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Source: Computer Shopper Winstone. March 1997 issue.

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PERFORMANCE TESTS

Graphical Workstations



The workstations in this roundup are all radically different beasts in terms of application support and components. But for pure processing horsepower, the 433-MHz Alpha 21164-based Digital Personal Workstation 433a shines.

What the Numbers Mean

Performance results, coupled with our pricing guidelines (\$10,000 to \$15,000), show that the Digital Personal Workstation 433a—based on the vendor's 433-MHz Alpha 21164 processor—stands out in this group. The x86-based Compaq Professional Workstation 5000 and HP Vectra XW 6/200 were surprisingly strong performers, but Digital's machine triumphed on our Pro/Engineer, Softimage, and AutoCAD tests. The Silicon Graphics O2 Desktop Workstation and the Sun Ultra 1 Creator 3D were no slouches, but as the incumbents in the workstation space, it seems both companies should consider price reductions in their more powerful systems to compete from a pure price/performance perspective against the x86 and Alpha systems in this price range.

There's no question that Sun Microsystems and Silicon Graphics are leading players in the mid- to high-end workstation markets, but neither vendor is as dominant from a performance standpoint in the lower-cost arena compared with the entrants running Windows NT. The Sun unit was somewhat crippled by its 64MB of installed RAM versus the other units' RAM of 128MB or more. While our price guidelines determined this configuration, we decided to conduct all tests with both 64MB and 128MB to get an idea how much of a performance boost added memory would give. Our charts reflect only the results with 64MB installed (performance differences are noted below, when applicable).

Comparing and contrasting the performance characteristics of disparate platforms is not easy. They have vastly different hardware designs, operating systems, and development environments. To cloud the issue further, workstations are often optimized or designed to excel at specific types of tasks and frequently are targeted to specific markets. Workstations might possess particular functionality to perform certain tasks well, such as video decoding or

3-D graphics rendering, and they might also implement proprietary memory designs and enhanced I/O buses to improve performance. Processor subsystems are either RISC or CISC designs and deliver different levels of integer, floating-point, and CPU/memory throughput. There are some similarities that ease the comparison somewhat. For example, most workstations will use 7,200-rpm SCSI-II or Ultra SCSI disk subsystems, and those with PCI buses typically use off-the-shelf 3-D graphics adapters with revised drivers or possibly minor silicon or firmware revisions.

Our performance tests exercise key workstation subsystems comparatively using applications that cross platform boundaries. Even with the minor variations in application versions and optimizations across platforms, we were still able to get a good idea of which platforms delivered the best overall performance for different types of tasks, such as 3-D graphics rendering, disk operations, and integer, floating-point, and memory operations.

AVS/EXPRESS

As the Render test has a variance of plus or minus 10 percent, we judge the Compaq, HP, and Sun units to have performed similarly. The Compaq and HP machines performed exceptionally, each aided by an adept 3-D graphics engine: the Compaq's OpenGL-based 16MB ELSA GLoria-L with 3Dlabs' Glint 500TX chip set and the Delta geometry processor, and the HP's 16MB Glint 500TX-based AccelGraphics AccelPRO, also with the Delta processor. Since the AVS/Express Render test focuses on 3-D graphics operations, the efficiency of its XGL library, its custom 3-D accelerator, and 15MB of 3D-RAM also resulted in top-notch performance for the Sun Ultra 1 Creator 3D Model 140E workstation. Adding memory to the Sun unit did not boost performance on either AVS test, indicating that the test was not sensitive to additional RAM.

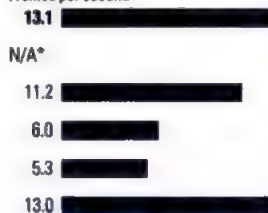
The SGI system delivered relatively poor results, both at 1,280-by-1,024 and at 1,024-by-768 true color, which indicates that either its OpenGL processing is slower than that of the others or the port of AVS for this platform is not optimized as well. Large and fast L2 caches definitely benefited the Compaq and HP Pentium Pro systems on the AVS Volume Ray Tracing test. Even with a large floating-point component, we suspect the test is also very CPU/memory-bound, so the faster and larger the L2 cache, the better.

PRO/ENGINEER

Like our AutoCAD test, our Pro/Engineer Trail File test uses a balanced mix of CPU, disk, and graphics processing, but Pro/E uses

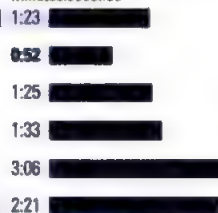
AVS/EXPRESS

Render
Frames per second



BETTER ►

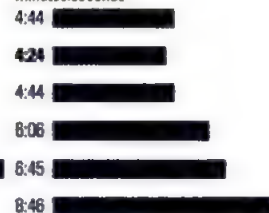
Volume Ray Tracing
Minutes:seconds



◀ BETTER

PRO/ENGINEER

Trail File
Minutes:seconds



◀ BETTER

Bold type denotes first place.

Compaq Professional Workstation 5000 (dual Pentium Pro)

Digital Personal Workstation 433a (Alpha 21164)

HP Vectra XW 6/200 (dual Pentium Pro)

SGI O2 Desktop Workstation (MIPS R5000SC; 1,024 x 768)

SGI O2 Desktop Workstation (MIPS R5000SC; 1,280 x 1,024)

Sun Ultra 1 Creator 3D Model 140E (UltraSPARC-I)

N/A*—Not applicable: A native version of this test is not available for this platform.

N/A*—Not applicable: The application software is not available for this platform.

N/A?—We did not run the test at this resolution.

OpenGL graphics (unlike AutoCAD). The Digital system really shines here: Its 0.35 micron, 433-MHz, 4-way superscalar and superpipelined Digital Alpha 21164 processor is the fastest processor of the bunch in industry benchmark tests (such as SPECint95 and SPECfp95), and it uses a 128-bit memory data bus to provide a 990-MBps peak throughput rate. This system also uses a 7,200-rpm 2GB Seagate Barracuda hard disk and Digital's 16MB Powerstorm 4D40T graphics adapter (a version of Intergraph's RealizM 3-D board specifically modified for Digital Alpha machines), resulting in a well-rounded and powerful performer.

The 200-MHz Pentium Pro-based Compaq and HP systems performed nearly identically on the Pro/E test, and posted scores surprisingly close to the Alpha-based Digital's score. The 256K of L2 cache in the Pentium Pro systems helps offset the incredible core speed of the Alpha, because the Alpha only incorporates 96K of L2 cache on chip. The Compaq's ELSA GLoria-L graphics card appears to have an edge over the HP system's AccelGraphics card, as seen in the results of other tests like the AVS/Express Render test, which heavily exercises OpenGL graphics. Given that both systems used 7,200-rpm SCSI drives, their Pro/Engineer performance was nearly identical.

The SGI unit performed respectably on this test as well, possibly boosted by its MIPS R5000SC processor's 512K of L2 cache, but the Sun system lagged, mostly because of its 64MB memory configuration and possibly the slower integer-processing ability of the system's 143-MHz UltraSPARC processor. With an additional 64MB of RAM installed (for informal testing), the Sun unit's score improved significantly; its score even edged out the SGI's score by 22 seconds, but this was still far behind the Digital Alpha and both Pentium Pro systems.

PV-WAVE

With such a mixed bag of results, we can really only generalize and say that all platforms did well on certain PV-Wave tests. The Compaq and HP systems did much better on the Advanced Rendering Isosurface test than anticipated, given that the test stresses floating-point processing, but the SGI unit was close behind. These results could be attributed to the optimization levels of the ports, but it's also possible that large integrated L2 caches benefited the Pentium Pro machines on this test.

The SGI unit won the Mapping test hands down. According to Visual Numerics, this test is also floating-point-oriented, and the SGI and Sun systems turned in much better results than the Compaq/HP duo, unlike on the Rendering test. These results could be due to the working set size of the test, the frequency of memory accesses, or simply the fact that this is a case where the code sequences used in the test match the R5000SC's and UltraSPARC's ability to process those specific instructions extremely well.

PV-WAVE

Advanced Rendering Isosurface Seconds	Mapping Minutes:seconds	Fill Contours Minutes:seconds	Mental Ray Renderer Minutes:seconds	OpenGL Hardware Renderer Minutes:seconds	AutoCAD Minutes:seconds
15.9	1:09	1:36	7:12	1:34	6:31
N/A**	N/A**	N/A**	4:56	0:46	4:30
19.3	1:17	2:01	6:57	1:40	6:20
N/A†	N/A†	N/A†	N/A†	N/A†	N/A†
20.4	0:10	1:20	9:57	1:45	N/A**
46.2	0:16	1:45	N/A**	N/A**	N/A**
◀ BETTER	◀ BETTER	◀ BETTER	◀ BETTER	◀ BETTER	◀ BETTER

The Fill Contours test stressed 2-D graphics bandwidth and integer processing, and both the SGI and Sun boxes performed well. It was interesting to watch the Compaq and HP machines run this test side by side: The HP was noticeably slower during the portion of the test that updates the screen. Adding memory to the Sun did not affect performance on this test.

SOFTIMAGE

Though we had the most difficult time installing Softimage, we had the easiest time creating tests with it that stressed the daylights out of these systems. Our rendering tests were extremely CPU-bound, and they differentiated the Compaq, Digital, HP, and SGI systems quite clearly. Again, the Digital's powerful Alpha chip contributed to its first-place showing on both Softimage tests. We expected the SGI to excel on this test given its heritage, but its elegant physical design, ease of use, and excellent video features can't compete with the sheer horsepower of one of the fastest microprocessors on the planet.

AUTOCAD

As on the Pro/Engineer test, the Digital workstation excelled on our AutoCAD test. This test stresses all subsystems, and the Alpha again showed off its balanced design. The Compaq and HP systems continued to demonstrate nearly equivalent performance, with the HP having a minor edge, most likely because of its slightly faster memory subsystem.

PHOTOSHOP

Dual- and quad-processor systems performed best on the Gaussian Blur, Lighting Effects, and RGB-to-CMYK Conversion tests, as all three of these functions are multithreaded. Considering that it's a uniprocessor system, the SGI did quite well on the floating-point-intensive Lighting Effects test. On the integer-based Gaussian Blur test, neither the SGI nor the Sun system could compete with the Pentium Pro machines. The pure integer performance of the Pentium Pro processor rivals that of many of the fastest RISC processors in the market today. The two Mac compatibles stood out on the Lighting Effects and RGB-to-CMYK Conversion tests because of their multiple processors, as well as the efficiency of the PowerPC 604e CPU at processing floating-point operations.

The PostScript Rasterize test stresses the speed of memory and disk I/O, and the Sun system pulled through with the best scores by a wide margin. In fact, we believe the Sun unit may have been assisted by its Visual Instruction Set on this test. When tested with 128MB of RAM, the Sun machine's performance did not change on the Gaussian Blur or PostScript Rasterize tests; Lighting Effects timings improved only slightly. But the system's timings on both the Image Resize and RGB-to-CMYK Conversion tests improved from roughly 21 seconds to about 12.—*Analysis written by Nick Stam*

SOFTIMAGE 3D EXTREME

BENCHMARK TESTS

How We Tested

BACKGROUND

Workstations are typically used for CAD, image processing, 3-D animation and rendering, data visualization, digital video editing, real-time processing, and a multitude of highly specialized scientific, software development, and financial applications. Vertical-market applications also dominate in the workstation space, as do complex custom applications that handle critical, performance-sensitive tasks. These applications often use very large models or data sets and require a great deal of system memory, abundant disk storage, powerful 3-D graphics hardware, and high-end processors.

The variety of complex applications and large data sets used by these machines makes it difficult to develop and execute broad-based performance-test methodologies. We considered many different testing approaches and recognize that there is no perfect method for comparing disparate platforms. The best method actually requires that you run your own applications on various platforms and determine the one that best fits your needs.

We considered using some of the industry-standard workstation benchmark tests such as SPECint95, SPECfp95, Xmark93, ViewPerf, and GLPerf, developed by the Standard Performance Evaluation Corp., or SPEC (available on the Web at www.specbench.org). Each of these tests allows the user to compile the benchmark test source code; this is complicated by determining which compilers and compiler switches to use, and which test options to set. Some

workstation vendors provide directions on the proper compiler switches to use, but in the past we have rarely obtained results equivalent to those provided by the vendors.

The SPEC Web site also provides executable binary tests for some platforms. But with these tests we can't be certain whether the compilers used are publicly available, or whether some "special" optimizations were performed that would not typically be found at the end-user level. A final option was to let vendors provide their own test results for the low-level tests, but we couldn't be sure that their hardware configurations would be consistent with what we received for our own testing.

To compare performance across platforms, we developed a set of tests using applications that have native versions available for multiple platforms. These applications included AVS/Express, Pro/Engineer, PV-Wave, Softimage 3D Extreme, AutoCAD, Adobe Photoshop, Adobe PageMaker, Microsoft Word, and Microsoft Excel.

Unfortunately, none of the selected applications worked across all platforms in native mode. Photoshop ran on all platforms except Digital's machine; Pro/Engineer and AVS/Express worked on all except the Macintosh-compatible systems; PV-Wave worked on all except the Digital and the Mac compatibles; Softimage worked on the Compaq, Digital, HP, and SGI systems only.

For measuring casual business application use on the workstations, we attempted to run our Business Winstone 97 benchmark tests, but they would not load under the Digital or SGI Windows

ADOBE PHOTOSHOP 3.0

Bold type denotes first place.

Compaq Professional Workstation 5000 (dual Pentium Pro)

DayStar Genesis MP 800+ (quad PowerPC 604e)

HP Vectra XW 6/200 (dual Pentium Pro)

SGI O2 Desktop Workstation (MIPS R5000SC; 1,024 x 768)

SGI O2 Desktop Workstation (MIPS R5000SC; 1,280 x 1,024)

Sun Ultra 1 Creator 3D Model 140E (UltraSPARC-I)

UMAX SuperMac S900/250dp RAID (dual PowerPC 604e)

PostScript Rasterize

Minutes

54

Gaussian Blur

Minutes:seconds

0:14

Image Resize

Seconds

6.8

68

2:20

11.0

55

0:13

7.5

N/A

1:09

22.2

66

1:14

23.2

37

0:54

21.0

67

2:23

10.1

◀ BETTER

◀ BETTER

◀ BETTER

N/A—We did not run the test at this resolution

ADOBE PHOTOSHOP 4.0

Bold type denotes first place.

Compaq Professional Workstation 5000 (dual Pentium Pro)

DayStar Genesis MP 800+ (quad PowerPC 604e)

HP Vectra XW 6/200 (dual Pentium Pro)

UMAX SuperMac S900/250dp RAID (dual PowerPC 604e)

PostScript Rasterize

Minutes

49

Gaussian Blur

Seconds

20.5

Image Resize

Seconds

14.3

68

42.2

9.1

50

19.8

14.9

66

29.5

9.0

◀ BETTER

◀ BETTER

◀ BETTER

ADOBE PHOTOSHOP 3.0 MULTIPROCESSING FOR THE MACINTOSH PLATFORM

Bold type denotes first place.

DayStar Genesis MP 800+ (quad PowerPC 604e)

UMAX SuperMac S900/250dp RAID (dual PowerPC 604e)

PostScript Rasterize

Minutes

69

Gaussian Blur

Seconds

17.8

Image Resize

Seconds

6.8

67

20.5

7.0

◀ BETTER

◀ BETTER

◀ BETTER

emulators. We also couldn't get Sun's Wabi emulator to work without fatal errors. We were able to run a few basic functions using the x86 versions of Microsoft Word and Microsoft Excel on the Compaq, Digital, HP, and SGI systems, and we used the Mac versions on the DayStar and UMAX boxes.

Unlike our roundups of mainstream x86-based PCs, this article does not use a specific filter for amount of memory installed, size of hard disk, or speed and number of CPUs. Instead, we asked each vendor to send us a system that was priced between \$10,000 and \$15,000, and to configure it appropriately for this market segment. Although we realize that this will cause some problems in comparing performance results, we felt strongly that performance, while important, is only part of an overall equation that also includes software support for the platform and specialized features for selected uses. The Sun system was the only unit here to have less than 128MB of memory installed. This configuration with 64MB of RAM fit within our pricing boundaries, but performance was definitely affected on some tests. We ran all tests on the Sun machine at both 64MB and 128MB (although we report the 64MB numbers) to gauge the impact of the extra RAM, and we note where improvements could be seen in "What the Numbers Mean."

SETUP AND CONFIGURATION

Generally, we tested all workstations as configured by the vendors, although we did perform a few hardware configuration changes and optimizations. We converted the HP machine's FAT-based

disk partitions to NTFS, but left all partitioning intact on all units. Also on the HP, we configured the AccelGraphics board settings for use with our AVS/Express, Pro/Engineer, and Softimage tests using the AccelGraphics control panel. Compaq engineers gave us a few optimization settings for Pro/Engineer that we were unable to initiate; Compaq failed to return our calls to solve the problem.

We standardized graphics resolution and color depth across all systems to the most common setting that allowed double buffering: 1,152-by-870 true color at a 75-Hz vertical refresh rate. Most systems provided that setting, or one close to it. The Sun unit was set to 76-Hz vertical refresh. Unfortunately, the SGI system allowed only 1,280-by-1,024 true color or 1,024-by-768 true color, but nothing in between. We ran the AVS, the Pro/Engineer, and most of the Photoshop tests at both 1,280-by-1,024 and 1,024-by-768 on the SGI system to see the difference in performance. Softimage didn't allow testing at 1,152-by-870, so we tested at 1,280-by-1,024 true color on the Digital and SGI systems. The HP unit didn't permit 1,280-by-1,024 true color, so we tested both it and the Compaq at 1,280-by-1,024 with 32 thousand colors for better comparison between the two systems.

We left all resident applications, demo programs, and utilities on all systems. We loaded the test applications and kept them on all systems as space permitted. Our Photoshop tests used a lot of disk space (over 300MB was needed for scratch-file space for the Photoshop PostScript Rasterize tests), so we had to delete the Pro/Engineer application on the SGI and Sun systems for the Photoshop tests to run properly.

We did not reset each system for each application test (in other words, we didn't reload the OS from scratch and install only the application being tested). Our methodology introduced some disk fragmentation and, depending on the file system, a slight loss of speed may have occurred as the disk heads had to traverse other data and application files present on the system. This should not affect results noticeably, however. Many of the tests were not disk-bound, so the effects of fragmentation are minimized or nonexistent in many cases. We ran no disk defragmentation utilities under Windows NT or Unix: In fact, we are not aware of any built-in defraggers for Unix (other than FSCK, which might report on disk defragmentation, although some third-party defraggers may exist), and only third-party defraggers exist for Windows NT.

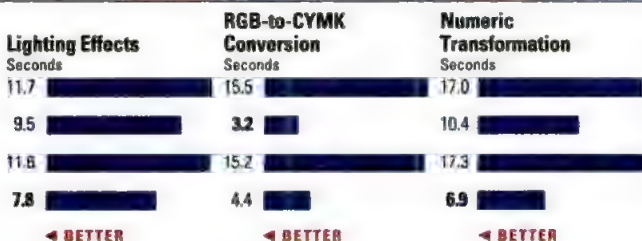
We enabled OpenGL usage for the Compaq, Digital, HP, and SGI systems when running AVS, Pro/Engineer, and Softimage. Neither Photoshop nor PV-Wave uses OpenGL. We configured both AVS and Pro/Engineer for XGL on the Sun system. While the Sun supports OpenGL 1.0, the later, performance-tuned releases are not shipping from Sun; engineers from Sun preferred that we use XGL.

For the PageMaker, Photoshop, Excel, and Word tests on the Mac compatibles, we left most memory settings at their defaults (modern memory manager off, virtual memory off, RAM disk off), but we set disk cache to 96K. We attempted to optimize Photoshop's use of system memory for each of the tested units.

The Application Tests

AVS/EXPRESS, VERSION 3.1

AVS/Express, from Advanced Visual Systems, is a data visualization and analysis program for use in such areas as medical imaging, oil and gas exploration and production, engineering analysis, finite element analysis, computational fluid dynamics, geographic information systems, environmental studies, defense, aerospace, telecommunications, financial analysis, and education/research. Through advanced graphics, imaging, visualization, and presentation tools, users can gain insights into large volumes of data. Features include 2-D and 3-D image display in 8- or 24-bit mode; 3-D property support for



BENCHMARK TESTS

color, material type, specular color, and transparency level; support for drawing and shading (flat and Gouraud), backface culling, and visibility; advanced rendering features such as transparency and texture mapping; and 3-D volume rendering including ray tracing.

Native graphics hardware acceleration such as OpenGL or XGL can be used, or a built-in software renderer (which includes support for advanced rendering functions such as transparency, anti-aliasing, and texture mapping) is available in the absence of hardware support. AVS/Express also includes a visual programming environment that allows users to visualize their data quickly and interactively.

We conducted two computationally intensive tasks using AVS/Express. With the help of Joe Peterson, senior engineer from Advanced Visual Systems, we conducted one test that was rendering-intensive and another that was computationally intensive. The **Render** test renders the earth with one GPS satellite in orbit. The satellite and its ground coverage are depicted using a 3-D cone composed of 21 triangles with a small arc trailing behind. The earth is a sphere made up of 1,200 triangles with a texture-mapped image applied. The objects on the screen were rotated for many frames; we used the AVS built-in timer and frame-per-second (fps) counter to get a frame rate. This test is almost completely bound by 3-D rendering. Performance differences among systems are dictated by 3-D graphics (OpenGL or XGL) hardware acceleration (if any).

The second test, **Volume Ray Tracing**, casts rays into a 64-by-64-by-64 cube of volume data that represents a theoretical hydrogen atom. A ray is cast for each pixel in the final image, and the ray will pass through *voxels* (small 3-D volume pixels or cubes) in the space of the larger volume. Each voxel traversed at each pixel is taken into consideration in the calculations in order to make a picture of the data in the atom. We report the amount of time that it took for each machine to complete these calculations.

Volume rendering is used to get a feel for data that has many gradations of value within a 3-D space. This test is highly floating-point-intensive and uses no 3-D (OpenGL) hardware. This test is also very dependent on constant screen resolutions across systems, because of the high amount of CPU calculations for each pixel. The SGI system can only be set to 1,280-by-1,024 (1,310,720 pixels) or 1,024-by-768 (786,432 pixels), versus 1,152-by-870 (1,002,240 pixels) for the other machines here. Therefore, its results cannot be directly compared with the others.

PRO/ENGINEER, VERSION 17.0

Pro/Engineer, from Parametric Technology Corp., is the leading Mechanical CAD (MCAD) software system. Geared for all stages of product design through final manufacturing, "ProE" allows users to sketch product features, create relations among various parts (all models are parameterized), assemble components using selected commands, create drawings and views, attach surfaces to parts and assemblies, and render 2-D and 3-D views of assemblies and fin-

ished products. A variety of other functions too numerous to mention are also available.

Parametric Technology created the **Trail File** test (similar to a macro that automates functions), which designs a fishing reel. The test included parts design, assembly, multiple 2-D views, and 3-D rendering operations. All system hardware was exercised, although the test—which uses both integer and floating-point math—heavily stresses CPU and memory operations. We used a single number representing the time that it took for each unit to execute the entire Trail File test from start to finish as the performance measure. This test uses OpenGL graphics hardware on the Compaq, Digital, HP, and SGI systems. It uses XGL graphics hardware on the Sun system.

PV-WAVE, VERSION 6.0

PV-Wave, from Visual Numerics, is an advanced visual data-analysis software system designed to enhance data comprehension, and to allow users to identify trends and better understand their information. PV-Wave includes a full suite of graphical routines, allowing users to display virtually anything from 2-D, 3-D, and 4-D plots and contours to geographic maps and volume visualization.

Our PV-Wave tests consist of three separate functions, which we timed on the tested systems. First is the floating-point-intensive **Advanced Rendering Isosurface** test. It uses MRI data and a ray-tracing engine to compute an image of an isosurface composed of 3-D voxel data of a human head. All rendering is done in software (no OpenGL or other hardware support is used). Since the output is just a 2-D image, the speed of this test depends very little on the display hardware and driver.

Our second test is a **Mapping** algorithm that uses PV-Wave's Map command to render a United States Geological Survey (USGS) data set displaying a map of the U.S. with all state boundaries drawn and a selected state filled in with color (Idaho, in this case). This test spends time reading the USGS data file from disk; there is also a fair amount of computation performed in the map transformation. Most of the computation is floating-point, with integer arithmetic used only at the end of the process when writing pixels on the screen.

The third test is a **Fill Contours** subfunction of the 2-D Contour command. An 8-bit image of a mandrill (an African baboon) is stored in a 2-D data array, and the Contour command first draws the 2-D image. Then we measure the speed of the Fill Contours subfunction, which fills in all contours by using a polygon-filling primitive on the lines generated by the Contour command. The polygon-filling primitive (built into the PV-Wave kernel) uses mainly integer arithmetic, as does the processing required to draw the polygons to screen.

SOFTIMAGE 3D EXTREME, VERSION 3.51

Softimage 3D Extreme, from Softimage Corp. (a wholly owned subsidiary of Microsoft), is a high-end 3-D animation product that

	MICROSOFT EXCEL	MICROSOFT WORD	
	Macro	Compound Document Load	Spell-Check
	Minutes:seconds	Seconds	Minutes:seconds
Compaq Professional Workstation 5000 (dual Pentium Pro)	0:25	8.4	0:04
DayStar Genesis MP 800+ (quad PowerPC 604e)	1:28	21.5	0:58
Digital Personal Workstation 433a (Alpha 21164)	0:47	21.4	0:13
HP Vectra XW 6/200 (dual Pentium Pro)	0:25	8.4	0:05
SGI O2 Desktop Workstation (MIPS R5000SC; 1,280 x 1,024)	8:25	33.0	2:17
UMAX SuperMac S800/250dp RAID (dual PowerPC 604e)	1:15	19.5	0:49
	◀ BETTER	◀ BETTER	◀ BETTER

provides many advanced functions including animation and dynamic simulations, enhanced relational modeling, flexible motion capture, inverse kinematics, B-splines, NURBS (nonuniform rational B-splines), object instantiation, real-time deformations, ray tracing, custom constraints, and polygon reduction. It also supports numerous gaming features. The Extreme version provides Meta-Clay, for density-based modeling of organic, sculptured objects; Mental Ray, for complete and customizable photo-realistic rendering including optical, volumetric, and environmental special effects and ray tracing; and Particles, for realistic simulation of fountains, explosions, and other effects using real-world dynamics.

We tested Softimage only on the Compaq, Digital, HP, and SGI systems, as Sun and Mac versions are not available. Our tests were composed of two 25-frame renders using a sample Softimage scene with its accompanying elements and primitives. We first used the **Mental Ray Renderer** to render all 25 frames, followed by the **OpenGL Hardware Renderer**; separate timings are reported.

For direct comparison, we tested the Digital and SGI systems at 1,280-by-1,024, 24-bit color; and we tested the Compaq and HP systems at 1,280-by-1,024, 16-bit color (the HP unit doesn't support 24-bit color at 1,280-by-1,024). We chose to back down the color depth instead of the resolution, because color depth matters little in the rendering operation.

AUTOCAD, PHOTOSHOP, PAGEMAKER, EXCEL, AND WORD

Autodesk's **AutoCAD** is the most popular mass-market CAD package and is available for multiple platforms. Adobe **Photoshop** is a leading image-editing program available across multiple platforms, and Adobe **PageMaker** is the leading desktop publishing and page-layout program for Macs and PCs. Microsoft **Word** and **Excel** are the leading word processor and spreadsheet programs for mainstream PC users.

We acquired **AutoCAD** for the Digital, SGI, Sun, and x86 units, but SGI and Sun were concerned that AutoCAD's features on their platforms were not as current as those on other platforms, even though they used the same Release 13 c4 the x86 and Digital systems used. To respect vendor wishes, we limited our AutoCAD tests to the Compaq, Digital, and HP systems.

Our AutoCAD test consists of a combination of AutoCAD script files and AutoLISP subroutines. Three functional areas are tested: opening both 2-D and 3-D drawing files; performing 2-D manipulations such as new entity additions, entity deletions, undo commands, regens, zooms, and pans; and 3-D manipulations, which combine 3-D view rotations and alterations, the Hide command, 3-D move operations, and a variety of rendering variations. CPU, disk, and graphics subsystems are all heavily stressed. The tests use the Autodesk WHIP driver and accelerate Autodesk's Heidi API calls instead of OpenGL calls. We publish a single result that reflects the time it took each machine to execute all scripts.

For **Photoshop**, we used the latest revision on all platforms. We tested the Compaq, DayStar, HP, and UMAX systems with Version 4.0; the Sun and SGI are still using Version 3.0.1. For a more equitable head-to-head comparison, we also tested the x86 and Mac-compatible systems with Version 3.0.5. When testing the Mac clones under Photoshop 3.0.5, we did a second run with DayStar's Multiprocessor filters installed. The DayStar filters are licensed to UMAX, and are publicly available to both systems, as well as Apple and others.

We measured the speed of five functions within Photoshop on each platform. Our first Photoshop test (created by Jeff Mace, *PC Magazine's* graphics and hardware project leader), is a **PostScript Rasterize** function. Our test loads, interprets, and rasterizes a 4.9MB vector graphics file generated by Macromedia Freehand and saved

in AI (Adobe Illustrator) format, which is an ASCII-based PostScript file. This complex file contains several 256-step color gradient-filled objects; we measure the amount of time it takes Photoshop to interpret and rasterize this file at 300 dpi, which results in a 139MB raster image file. The test stresses integer processing, memory, and disk I/O.

PC Magazine contributing editors Daniel Grotta and Sally Wiener Grotta worked with Adobe engineers to develop the remaining tests, including the **Gaussian Blur** test, which stresses integer math; the **Image Resize** test, which stresses memory bandwidth; the **Lighting Effects** test, which stresses system floating-point capabilities; and the **RGB-to-CMYK Conversion** test, which stresses the CPU and L2 cache architecture. Multiple processors paid off on the CMYK-to-RGB Conversion, Lighting Effects, and Gaussian Blur tests, which are all multithreaded. In addition, we ran a Photoshop 4.0 **Numeric Transformation** test on both the x86 and Mac-compatible units.

We conducted two tests under **Adobe PageMaker 6.0** on both Mac and x86 platforms. The **BigFile** test uses a large Word document and changes font sizes, leading, color, and style throughout the document. This test is processor-intensive, with some disk activity as well. The **Place Pix** test places about 50 JPEG pictures onto an empty 101-page document. This test significantly exercises disk I/O. For each test we report how long it took to complete the task.

Our **Microsoft Excel** test used a macro that performed numerous recalculations, cuts and pastes, scrolls, page down/up functions, and graphing functions. We report the time it took for each system to complete the entire macro from start to finish. We ran Excel, Version 7.0, on the Pentium Pro systems and Version 5.0a on the DayStar and UMAX units. We ran these tests (as well as the Microsoft Word tests) at the same resolution and color depth as other workstation tests, assuming that users wouldn't change settings for casual business software use.

We were unable to run any of these tests on the 143-MHz Sun UltraSPARC-based system, because we could not get the Wabi Version 2.2 emulator working properly. In past testing of a 167-MHz Sun Ultra-I Creator 3D system, we noted x86 performance equivalent to a 486DX2/66 system, which is adequate for casual use.

Our **Microsoft Word** tests used Word, Version 7.0, on the Compaq and HP systems, and we ran Version 7.0 under x86 emulation (SoftWindows) on the SGI system. We ran Version 6.0.1 on the Mac-compatible DayStar and UMAX machines. The difference between Version 6.x and Version 7.0 is significant: It appears that Version 7.x is more optimized. The Word tests include a **Compound Document Load** of a document made up of a mixture of text, images, and tables, and a **Spell-Check** of a text file with no spelling errors and no new words required to be added to standard or custom dictionaries. The Compound Document Load test heavily stresses disk subsystems, while the Spell Check test is mostly a CPU/memory-intensive integer operation. We timed both tests.

OTHER COMPARISON AND METHODOLOGY ISSUES

Because all applications did not run across all platforms, all of our performance comparisons were focused on selected subsets of applications running across select systems. Pro/Engineer and Photoshop were most telling, because they worked across most platforms. Photoshop was the only application that contained multithreaded functions that exercise the multiple processors in the Compaq, DayStar, HP, and UMAX systems. Pro/Engineer, PV-Wave, and Softimage were unavailable for the Macintosh compatibles, so the DayStar and UMAX machines were compared with the Compaq and HP systems running PageMaker, Photoshop, Word, and Excel only.

AWE64 SOUNDS OF WAR

1. Kaboom!
2. Grenades.
3. Deafening Silence.
4. 64mm Shells.
5. The Crackle Of Uzi Fire
6. "Incoming!"
7. "That Was A Close One."
8. Random Gunfire.
9. "Private Curtis Jones, 51st Airborne"
10. Anti-Tank Guns.
11. The Clink Of An Aluminum Mess Kit.
12. Dangling Dog Tags.
13. Ricocheting Bullets.
14. Sigh Of Relief.
15. A Harmonica Playing Yankee Doodle.
16. Give peace a chance.
17. Flight of the Valkyrie.
18. Shovels Diggin Trenches.
19. Prayer.
20. Dirty Jokes.
21. "Sniffle."
22. Nervous Laughter.
23. Letters From Children.
24. Bombs bursting in air.
25. Battle Plans.
26. "Over The Top, Boys!"
27. The Battle Hymn Of The Republic.
28. Bullets Whizzing Past Your Helmet.
29. Random Snipers.
30. Surface To Air Missiles.
31. Anti-Aircraft Fire.
32. The Doors Playing "The End"
33. The Whistle Of Tracers.
34. "Medic! Medic!"
35. The Star Spangled Banner.
36. The Thunder Of An Air Strike.
37. "Hit The Dirt."
38. A Rain Of Debris Landing All Around You.
39. Taps.
40. "Uurrrrrp!"
41. Low Flying Sidewinders.
42. Straling From The Air.
43. Ak-47 Assault Rifles.
44. Standard Issue M-16's.
45. The Sharpening Of Bayonets.
46. The Hiss Of Mustard Gas.
47. A Declaration Of Peace.
48. Rain.
49. Howitzers.
50. The Cheer Of Victory.
51. Quiet.
52. The Low Rumble Of Bombs In The Distance.
53. The Squawk Of A Radio Call For Help.
54. Com chatter.
55. "Surrender Now!"
56. Troops Marching.
57. Jungle Animals.
58. "The Biscuits In The Army They Say Are Mighty Fine."
59. The Angry Croak Of Your Commander.
60. A Tropical Storm.
61. A Blazing Oil Well Fire.
62. Unrolling Adhesive Bandages.
63. "Ugh!"
64. "I Wanna Go Home."



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Compaq Computer Corp.

Compaq Professional Workstation 5000

With its new line of workstations—represented here by the Compaq Professional Workstation 5000 (\$10,200 street)—Compaq Computer Corp. moves into what, for it, is an unexplored market. While not unused to dealing with high-end apps, Compaq's only real experience in this space has been with its long-running ProLiant network server line. But given Compaq's incredible success in the server market, we have little doubt of this vendor's ability to support its new workstations. Compaq markets these systems to users who want better graphics performance than they're getting from their PCs, as well as users who want a system that's cheaper and easier to integrate than workstations from non-Intel/Windows NT vendors. All told, the 5000 is a credible entry into this market.

Hardware requirements in this market are very stringent, and Compaq has made a good start with a group of cutting-edge components, such as its hard disk interface and graphics adapter (Ultra Wide SCSI and ELSA's GLoria-L 3-D graphics accelerator). Choosing a graphics adapter vendor with an understanding of this market makes Compaq a realistic player more quickly than if it had tried to build a suitable graphics card itself.

If Compaq has a hardware-related weakness, it's in the fact that, for this company, the 5000 is the end of the line. This is Compaq's top-of-the-line workstation, and while it compares favorably with the other products in this roundup, it doesn't have the advantage that almost every competitor here has: a complete line of workstation-class systems of which the representative here is either the entry-level model or a not particularly bulked-up machine.

Users who are moving into the workstation world and are committed to the x86-based Windows NT platform are unlikely to find any flaws with the Compaq unit. But those looking for a growth platform and a dedicated application without having a commitment to a particular OS, might be better served either by going with a Unix platform that supports their needs or by waiting for Pentium II-based



or quad-processor-capable workstations from Compaq.

THE PLATFORM

By combining dual 200-MHz Pentium Pro CPUs and a Ultra Wide SCSI disk controller (capable of 40-Mbps data transfers) with an ELSA GLoria-L OpenGL hardware accelerator, Compaq has built a system capable of going head to head with comparably priced workstations from the more traditional Unix/RISC-based work-



Compaq's Pentium Pro-powered workstation is an impressive entry in this competitive market.

station vendors. But what's more amazing is that our test results showed that even with applications that play on the floating-point strengths of the RISC boxes, the Compaq machine provides comparable performance.

The GLoria-L 3-D graphics controller was an excellent choice for this machine. The card—which comes with 8MB of DRAM for the Z-buffer and texture mapping and 8MB of VRAM for the frame buffer and 3-D functions—is in large part responsible for the 5000's excellent per-

formance on our tests. This card combines two of the current hot graphics technologies: 3Dlabs' Glint chip set for high-performance 3-D acceleration and the S3 ViRGE chip set for standard video. The adapter includes accelerated OpenGL drivers for the most common high-end Windows NT apps, such as Pro/Engineer, Softimage, and 3D StudioMax.

The system's integrated Ultra Wide SCSI adapter lets you take advantage of the SCSI optimizations built into Windows NT 4.0. And using the available bay to add a second Ultra SCSI hard disk allows you to use Windows NT to stripe data across both drives, providing some performance increase in disk I/O-intensive applications. There is also an expansion port for the SCSI bus on the back of the case. However, Compaq has chosen to use an IDE CD-ROM drive, which will suck up CPU cycles when in use.

The system's performance on rendering-intensive tests (like the AVS Render test) was top-notch, and slightly better than that of the Sun entry. Its AVS Volume Ray Tracing timing was the best of this roundup, and it was also a standout performer on our Photoshop 3.0 and PageMaker measures.

ACCESSIBILITY AND EXPANDABILITY

The 5000 comes in an oversized pizza-box-style case. It's solidly built and quite easy to service if you know what you're doing (we suggest reading the manual first). The system has the expected full complement of I/O ports, including an auto-sensing Fast Ethernet adapter using Compaq's NetFlex-3 technology; there are also connectors for Compaq's Business Audio. Inside, the expansion slots are all on an easily removable card cage that lifts out to expose the motherboard. This allows easy access to the system CPUs, which is important if you buy the single-CPU model with plans to upgrade. To upgrade memory, you simply disconnect a few cables (once the card cage has been removed) and slide the motherboard out.

In our test configuration (with hard disk, CD-ROM drive, and floppy disk drive installed) there was only one drive bay, however. Also, as is the case with most systems that use DIMM, adding RAM up to the maximum 512MB supported means

SUMMARY OF FEATURES (PART 1)

Graphical Workstations: System Features

Price of tested configuration For machines sold through resellers, assume that street prices will be 15 to 20 percent lower than list prices. Some vendors factor this discount into their quoted prices; in such cases, we indicate that the cited price for the workstation is a street price. All street prices are rounded off to the nearest \$10.

Installed system RAM Graphical workstations generally use traditional fast-page-mode DRAM for the system memory. Some workstations, however, use EDO (extended data out) DRAM, which can marginally boost

performance over standard DRAM. Others have chosen synchronous DRAM (SDRAM), which synchronizes the timing of the memory clock with the processor's clock and avoids the extra clock cycles that standard DRAM needs.

Hard disk interface *Fast SCSI-2* supports transfer rates up to 10 MBps; *Fast/Wide SCSI-2* supports transfer rates up to 20 MBps. *Ultra SCSI* (also called SCSI-3 or Fast 20) supports a transfer rate of 20 MBps. *Ultra Wide SCSI* (SCSI-3 or Fast-40) supports a transfer rate of 40 MBps.

Hard disk capacity We report the capacity in megabytes (units of 1,048,576 bytes). Some manufacturers quote figures in millions of bytes, which makes the capacity appear about 5 percent larger.

CD-ROM drive (speed and interface) Each of the graphical workstations we tested included a CD-ROM drive. Many were compatible with SCSI standards and have correspondingly high throughput rates. The others fit the ATAPI specification, which enables CD-ROM drives to act much like hard disks and to be connected to Enhanced IDE interfaces.

	Compaq Professional Workstation 5000	DayStar Genesis MP 800+	Digital Personal Workstation 433a	HP Vectra XW 6/200	Silicon Graphics O2 Desktop Workstation	Sun Ultra 1 Creator 3D Model 140E	UMAX SuperMac S900/250dp RAID
Price of tested configuration	\$10,200 (street)	\$11,500 (street)	\$11,300 (street)	\$10,874 (list)	\$11,500 (street)	\$12,995 (list)	\$9,800 (street)
Price of monitor	\$1,900 (street)	\$1,700 (street)	\$2,000 (street)	\$1,880 (street)	Included	Included	\$1,900 (street)
Processor type (speed)	Two Pentium Pro (200-MHz)	Four PowerPC 604e (200-MHz)	Alpha 21164 (433-MHz)	Two Pentium Pro (200-MHz)	MIPS R5000SC (180-MHz)	UltraSPARC-I (143-MHz)	Two PowerPC 604e (250-MHz)
Installed operating system	Windows NT 4.0	MacOS 7.5.5	Windows NT 4.0	Windows NT 4.0	IRIX 6.3	Solaris 2.5.1	MacOS 7.5.5
Bus interface	PCI	Apple RISC Bus	PCI	PCI/ISA	N/A	SBUS	Apple RISC Bus
Installed system RAM	128MB EDO DRAM	128MB DRAM	128MB SDRAM	128MB ECC DRAM	192MB DRAM	64MB DRAM	128MB
Hard disk	Compaq	Quantum Atlas XP32150	Seagate Barracuda ST32550W	Quantum Atlas II	IBM	Seagate Barracuda ST32550WC	Two Quantum 4550S
Capacity and interface	4GB Ultra Wide SCSI	2GB Fast/Wide SCSI-2	2GB Ultra Wide SCSI	4GB Ultra SCSI	4GB Ultra SCSI	2.1GB SCSI-2	4GB Ultra SCSI (each)
Monitor	Compaq QVision 21	Mitsubishi Pro21TX	Digital VRT21-WA	HP Ergo Ultra VGA 1600	Sony	Sony	Mitsubishi/UMAX High Resolution
CD-ROM drive (speed and interface)	Compaq (8X IDE)	NEC CDR-1410 (8X SCSI-2)	Toshiba XM-5602B (8X EIDE)	Hitachi CDR-7930 (8X ATAPI)	Toshiba (4X ATAPI)	Toshiba XM-5401B (4X ATAPI)	Matsushita CR506 (8X SCSI)
Network adapter	Compaq NetFlex-3 10/100TX (integrated on motherboard)	10 Mbps (integrated on motherboard)	Digital 10/100TX (integrated on motherboard)	HP DeskDirect 10/100TX	10/100 Mbps (integrated on motherboard)	10/100 Mbps (integrated on motherboard)	UMAX E100 Extended Performance Card
Motherboard Components							
Motherboard manufacturer	Compaq	DayStar	Digital	Hewlett-Packard	Silicon Graphics	Sun	UMAX
Chip set	Intel 440FX	Apple Tsunami	Digital/Pyxis	Intel 450KX	Proprietary	Sun	Apple chip set/
BIOS manufacturer and version (or date)	Compaq (10/9/96)	Apple ROMs	Digital (1/97)	Hewlett-Packard QGG 96.18	Proprietary	Proprietary	Apple ROMs
Flash BIOS/Plug and Play BIOS	■ ■	N/A	■ ■	■ ■	Proprietary	Proprietary	Proprietary
Expandability							
Maximum system RAM	512MB	1.5GB	1.5GB	512MB	256MB	1GB	1GB
Expansion-bus slots	1 ISA, 3 PCI, 1 ISA/PCI	6 PCI	5 PCI, 3 ISA/PCI	2 ISA, 3 PCI, 1 ISA/PCI	1 PCI	2 SBUS	6 PCI
Accessible drive bays (5.25", 3.5")	2, 1	2, 0	3, 1	3, 2	2 rear (proprietary)	1, 1	2, 2
Internal drive bays (5.25", 3.5")	0, 1	0, 7	0, 2	0, 2	None	0, 2	0, 2
Parallel/serial/mouse ports	1, 2, 1	0, 2, 1	2, 1, 1	1, 2, 1	1, 2, 1	1, 2, 1	0, 2, 2
Service and Support							
24-hour, 7-day live technical support	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/3 years	1 year/1 year	3 years/3 years	3 years/3 years	1 year/None	1 year/1 year	1 year/1 year
On-site service charge (1 year)	Included	N/A	Included	Included	Varies	Varies	Included
24-hour turnaround for replacement parts	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature.

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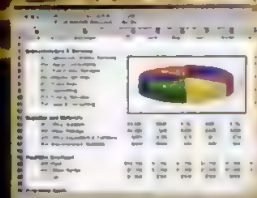
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4 MB
\$279**



January 1997



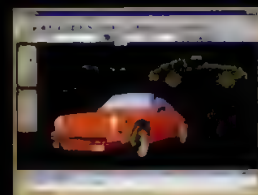
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*Quote from PC Computing Dec 1995. **Estimated street price for 4 MB. All performance tests conducted by Matrox Graphics Inc. on a Dell Dimension XPX Pro 200MHz system with 32MB of EDO DRAM and 256K of cache. WinBench 97 Business Graphics conducted at 1024x768x16.7M colors with 75Hz vertical refresh under Microsoft Windows NT 4.0. Matrox Millennium, ATI 3D Pro Turbo + PC21V, Diamond Stealth 3D 3000 and Number Nine Imagine 128 Series 2 were configured with 4 MB of memory for the PCI bus using driver releases 3.06, 3.1.76, 2.83 and 2.21 respectively.

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replacing the two 64MB DIMMs that ship in the dual-CPU configuration. And in our test machine, the system speaker, which is attached to the card cage, had an overly long wire lead that hung down into the heat sink of the second processor (Compaq is addressing this issue).

In the category of mildly annoying problems, the system lacks the game port found on some of its competitors. The lack of a game port may sound minor, but if you plan to use an alternate input device that requires a game port, you'll need to add a third-party game card and disable the on-board sound system.

In case your organization has standardized on Compaq PCs, the built-in management features integrate well into the Compaq management scheme. It can pretty much be said that no one has ever been fired for buying a Compaq, and in the case of the Professional Workstation 5000, with its excellent performance and strong features set, you might just get a promotion.—*David Chernicoff*

Compaq Professional Workstation 5000. Street price: \$10,200. Compaq Computer Corp., Houston; 800-345-1518; fax, 281-518-1442; www.compaq.com.

DayStar Digital Inc.

Genesis MP 800+

UMAX Computer Corp.

SuperMac S900/250dp RAID

Given Apple Computer's poor sales figures and recent performance in the stock market, it may seem that the competition between Macs and PCs is all but over. But before you count the Mac platform as a hit-and-run victim of the Wintel juggernaut, you may want to take a look at two high-powered Mac compatibles, DayStar Digital's Genesis MP 800+ and UMAX Computer Corp.'s SuperMac S900/250dp RAID.

Both are designed for workstation-like performance, and both come equipped with multiple CPUs and 24-bit video accelerators. When executing certain Photoshop functions specifically optimized to take advantage of these machines' MP capabilities, performance was equal to or better than that of the dual Pentium Pros tested here. Naturally, all this power does not come cheaply, al-



though pricing does compare very favorably with others in this roundup. As tested, the quad-CPU DayStar unit weighs in at \$11,500 (street; add \$1,700 for a 21-inch monitor), and the dual-CPU UMAX machine costs \$9,800 (street; add \$1,900 for a 21-inch monitor).

MULTIPROCESSING AND DAYSTAR

DayStar has been in business for years, providing processor upgrade boards that plug into the Mac's Processor Direct Slot (PDS), and the vendor has significant experience with Mac hardware design and the MacOS. DayStar is now the leading force in Mac-compatible multiprocessing OS extensions and system designs. Although the company licenses system-control ASICs from Apple, both Apple and UMAX license DayStar's multiprocessing APIs. UMAX uses DayStar's technology in its MP systems, and Apple has built the DayStar API support into System 7.6.

System 7.x is not an SMP-capable OS: To take advantage of multiple CPUs, software vendors must convert their apps to use the DayStar API. System 7.6 does not use multiple CPUs itself, nor does it allocate processes to multiple CPUs.

DayStar's extensions provide OS-level control for apps written to the API to apportion parts of their workloads across multiple CPUs. Although DayStar's first Genesis machine was off to a slow start last year because of a lack of MP applications, many large players have already converted key applications or are in the process of converting their apps to support DayStar MP systems.

Apple's recent acquisition of NeXT Computer will result in a new and powerful multitasking OS called Rhapsody (displacing the long-awaited but elusive Copland) and will play nicely into DayStar's MP technology. Rhapsody requires software rewrites to leverage multithreading,

but when Rhapsody strikes its chord at the end of 1997 in a Premiere Release, DayStar will provide a hardware abstraction layer that allows Rhapsody and its multithreaded apps to interface directly with its MP systems. Later in 1998, when the Unified Release of Rhapsody ships, it will be able to run existing System 7.x apps in a compatibility mode called the "blue box." Multithreaded apps using DayStar's current MP APIs will run unchanged in the blue box.

SOFTWARE LAGS

Our tests showed that MP software does indeed lag far behind the hardware. DayStar created 20 MP plug-ins for Photoshop 3.0.5, including Crystallize, Displace, Extrude, and Lens Flare, among others. Adobe also provides similar filters for both Versions 3.0.5 and 4.0 of Photoshop, and DayStar will shortly release MP filters for 4.0. Among the MP-compliant programs currently available on the Mac platform are Adobe After Effects and Premiere, Apple's QuickDraw 3D, Deneba's Canvas, and MetaTools' Studio Effects. The one area that should benefit the most from MP technology is multimedia, but the software is lacking here as well.

The two Mac compatibles did poorly on our Excel and Word tests, and again the culprit is software lag. While Microsoft's Office 95 is more recently optimized 32-bit code, Office for the Mac contains older versions of the applications and appears to be less optimized. Part of the problem is the user base: There are a lot more PCs than Macs, so ISVs' priority is Windows, not System 7. Microsoft says that it is working on an improved version of Office but declined to say when it will be ready to release even an alpha version.

THE DAYSTAR UNIT

The DayStar system is housed in an extra-wide tower case, which is one of the best constructed and most expandable we've seen. Nine internal bays are present in addition to the standard 3.5-inch floppy disk drive and 8X CD-ROM drive bays (a 12X or 12X/16X drive will be standard by the time you read this). Most of the drives easily install sideways on snap-on rails.

SUMMARY OF FEATURES (PART 2)

Graphical Workstations: Graphics Features

	Compaq Professional Workstation 5000	DayStar Genesis MP 800+	Digital Personal Workstation 433a	HP Vectra XW 6/200	Silicon Graphics O2 Desktop Workstation	Sun Ultra 1 Creator 3D Model 140E	UMAX SuperMac S900/250dp RAID
2-D graphics accelerator chip	S3 ViRGE	Number Nine Imagine 128	RealizM	Advanced Logic AL G2064	Proprietary	Sun STP 3100BGA	IMS
Type of graphics memory	DRAM, VRAM	VRAM	SDRAM	VRAM	DRAM	3DRAM	VRAM
Data path	64-bit	128-bit	128-bit	64-bit	Info not available	64-bit	128-bit
Maximum noninterlaced refresh rate	100 Hz	100 Hz	85 Hz	75 Hz	75 Hz	112 Hz	75 Hz
Display characteristics							
Maximum installable memory	8MB VRAM, 16MB DRAM	4MB	48MB	8MB VRAM, 8MB DRAM	256MB (pooled with main memory)	15MB	8MB VRAM
Maximum number of colors/refresh rate at:							
1,600 x 1,280	16.7 million, 80 Hz	32,768, 80 Hz	N/A	N/A	N/A	N/A	16.7 million, 60 Hz
1,280 x 1,024	16.7 million, 100 Hz	32,768, 80 Hz	16.7 million, 85 Hz	16.7 million, 75 Hz	16.7 million, 75 Hz	16.7 million, 76 Hz	16.7 million, 75 Hz
1,152 x 864	16.7 million, 100 Hz	16.7 million, 90 Hz	16.7 million, 85 Hz	16.7 million, 75 Hz	N/A	16.7 million, 76 Hz	16.7 million, 100 Hz
1,024 x 768	16.7 million, 100 Hz	16.7 million, 100 Hz	16.7 million, 85 Hz	16.7 million, 75 Hz	16.7 million, 75 Hz	16.7 million, 77 Hz	16.7 million, 75 Hz
800 x 600	16.7 million, 100 Hz	16.7 million, 100 Hz	16.7 million, 85 Hz	16.7 million, 75 Hz	16.7 million, 75 Hz	16.7 million, 50 Hz	16.7 million, 72 Hz
640 x 480	16.7 million, 100 Hz	16.7 million, 100 Hz	16.7 million, 85 Hz	256, 75 Hz	N/A	16.7 million, 112 Hz	16.7 million, 67 Hz
Software Features							
On-the-fly resolution adjustment and refresh rate control	■ (via Windows NT 4.0)	■	■	■	■	■	■
On-the-fly color depth adjustment	■ (via Windows NT 4.0)	■	■	■	■	■	■
Virtual desktop features:							
Maximum size (pixels)	N/A	N/A	N/A	N/A	N/A	10,240 x 8,192	1,920 x 1,080
Pan and zoom/Auto-centering	■	■	■	■	N/A	■	■
Color calibration of RGB value	■	■	■	■	■	■	■
Video playback utility	■	■ (via OS)	■	■	■	■	■
Easy access to graphics utilities	■	■	■	■	■	■	■
3-D Functions and API Support							
3-D rendering chip	3DLabs Glint 500TX	None	Digital Powerstorm	3DLabs Glint 500TX	Silicon Graphics	Sun STP3100BGA	None
Geometry processor chip	3DLabs Glint Delta +	N/A	None	3DLabs Glint Delta	MRE	VIS (in CPU)	N/A
Amount of Z-buffer memory	8MB	N/A	Shares 16MB frame buffer memory	Shares 8MB texture memory	Limited to main memory size	4MB	N/A
Z-buffer bit depths supported	32	N/A	24	24	24	28	N/A
Accelerated double-buffered color depths (bits):							
1,600 x 1,280	16	N/A	N/A	N/A	N/A	N/A	N/A
1,280 x 1,024	16	N/A	24	8, 15	32	24	N/A
1,024 x 768	32	N/A	24	8, 15, 24	32	24	N/A
800 x 600	32	N/A	24	8, 15, 24	32	24	N/A
640 x 480	32	N/A	24	8	N/A	24	N/A
Texture memory	24MB	N/A	32MB	8MB	Limited to main memory size	Limited to main memory size	N/A
Frame buffer memory	8MB	N/A	16MB	8MB	Limited to main memory size	15MB	N/A
Supports most recent version of OpenGL	■	N/A	■	■	■	■	N/A
Other 3-D APIs supported	Direct 3D, Heidi	N/A	None	Heidi	Inventor, Performer	XGL, PHIGS	N/A
3-D Chip Set Features							
Bilinear/trilinear filtering	■	N/A	■	■	■	■*	N/A
MIP mapping	■	N/A	■	■ (via software)	■	■*	N/A
Trilinear MIP mapping	■	N/A	■	■ (via software)	■	■*	N/A
Perspective texture correction at 8 bits and 16 bits	■	N/A	■ (24-bit)	■	■	■*	N/A
Anisotropic texture mapping	■	N/A	■	■	■	■*	N/A
Video texture mapping	■	N/A	■ (via hardware)	■	■	■*	N/A

N/A—Not applicable: The product does not have this feature.

* Software texturing with hardware-accelerated Z-buffering.

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3.5" floppy drive
100MB Iomega Zip drive

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PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard
Microsoft Windows[®] 95 and MS[®] Plus[!] CD

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12X SCSI CD-ROM drive, 3.5" floppy drive
100MB Iomega Zip drive

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PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard
Microsoft Windows 95 and MS Plus[!] CD

Multimedia Xcitement Pak: POD, Adobe
PhotoDeluxe, Billboard Music Guide,
Blockbuster Entertainment Guide and
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5-year/3-year limited Micron Power warranty

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16-bit stereo sound card and speakers

PCI 64-bit 3D video, MPEG, 2MB EDO RAM
Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard

Microsoft Windows 95 and MS Plus[!] CD
Microsoft Works CD
5-year/3-year limited Micron Power warranty

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3.1GB EIDE hard drive
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Intel 200MHz Pentium Pro processor
32MB EDO RAM
4.1GB EIDE hard drive
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processors
256KB internal L2 cache, flash BIOS

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16-bit stereo sound and speakers
PCI 64-bit 3D video, MPEG, 4MB EDO RAM

Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard
Microsoft Windows 95 and MS Plus[!] CD
5-year/3-year limited Micron Power warranty

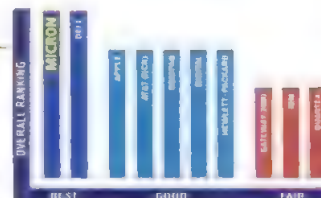


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Sources: PC World best overall PC company for reliability and service, December 1998

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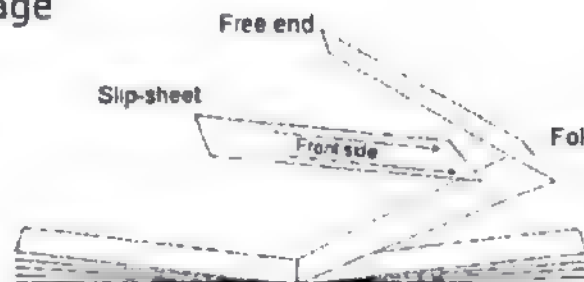
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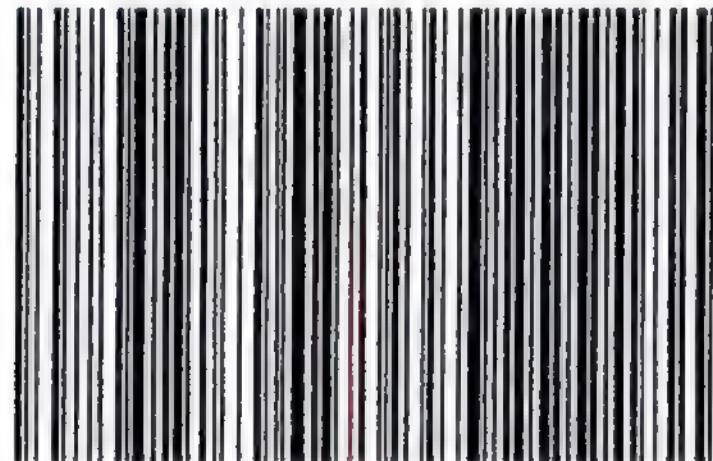
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3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

Folded edge of the page

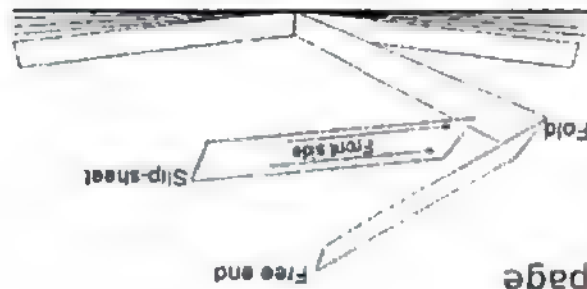
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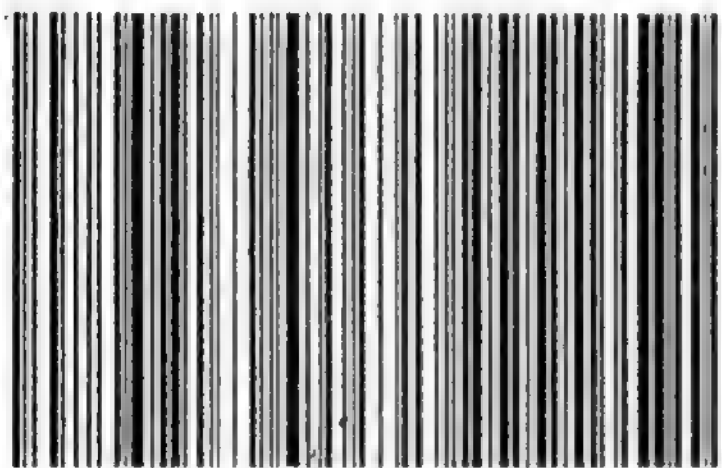
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

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Gbs5lipBack-0018

Back

1. Follow instructions on the other side

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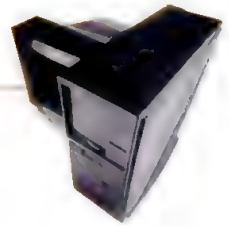
All the wondrous things the Intel Pentium processor does for performance, Pentium with MMX does better. Much. Modem operations. 2D and 3D graphics. Video. Audio. The Internet. Memory. Video conferencing and whiteboard collaboration. MMX gives your entire system – and your senses – a boost like never before.



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3.1GB EIDE hard drive
17" Micron 17FGx, .26dp (15.8" display)

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512KB pipeline burst cache, flash BIOS
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100MB Iomega Zip drive
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Advent A1270 2x25 watt stereo speakers in P200
16-bit stereo sound card and speakers in P166
33.6 fax/modem, speakerphone, voice mail
Microsoft Phone telephony software

Internet ready: SPRYNET Internet trial membership, Microsoft Internet Explorer America Online and CompuServe trial memberships
PCI 64-bit 3D video, MPEG, 2MB EDO RAM
Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard
Microsoft Windows 95 and MS Plus! CD
Microsoft Works CD

SystemSoft SystemWizard application for automated problem resolution
Quicken Financial Pak: Quicken Deluxe, Quicken Financial Planner, Quicken Parents' Guide to Money, Quicken Family Lawyer
Family Pak: ABC by Dr. Seuss, Thinkin' Things Collection 1, Earthworm Jim and Mechwarrior 2
Microsoft Home Bundle
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Kodak DC25 digital camera **\$499**
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* V34 modem includes trial memberships to CompuServe and America Online.

* V34 modem includes trial memberships to CompuServe and America Online. Requires sound card.

* Upgrade from systems with standard Micron 17" 17FGx color monitor.

* Upgrade from systems with standard 64-bit 2MB video card. 1st year on-site service is available in the United States and in limited areas in Canada from third-party service provider per customer's agreement with provider.

* 2nd year and 2nd & 3rd year offerings are available in the United States only.

Options and accessories available with system purchase only.

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Designed for
 Microsoft
Windows 95

DECEMBER 1996

PC
FEBRUARY 1997
MICRON MILLENNIA
Mag. P200

The machine comes equipped with four 200-MHz PowerPC 604e CPUs on a single large daughterboard (the vendor calls its MP hardware *nPower*). In addition, the daughterboard is bounded by a bracket that makes removing or upgrading easy. There is also 512K of L2 cache on the motherboard. The board has 12 memory slots that accommodate 168-pin DIMMs; by installing 128MB DIMMs, you can expand total system memory to 1.5GB.

Like all Apple PowerPCs, most of the DayStar's peripherals are attached via built-in SCSI-2 internal and external connectors. In addition, the unit features integrated 10-Mbps Ethernet, sound input/output ports, two modem/geoports, and a single ADB (Apple Desktop Bus) port for keyboard, mouse, or tablet connections.

Rather than marketing through dealers or directly to the public, DayStar sells stripped-down computers (with no memory, hard disks, graphics cards, keyboard, or mouse, but with four processors) to VARs. The unit we tested came configured with four 32MB DIMMs (128MB of RAM), a 2GB Quantum Fast SCSI hard disk, a Number Nine Imagine 128 graphics accelerator board with 4MB of VRAM, and a mouse.

THE UMAX SYSTEM

The UMAX came in a mini-tower case with a door covering the CD-ROM drive and floppy disk drive on the front panel. The first thing most users will do is permanently remove the door, since ejecting the CD-ROM will push it open, and when you attempt to close the drive, it hangs up on the rear of the door. The UMAX machine offers good expandability, though not as much as the DayStar: It has five drive bays besides the 8X CD-ROM drive, three of which can house removable devices.

UMAX manufactures its own motherboards with Apple ROMs and parts, and is thus 100 percent compatible. However, it differs considerably from the 9500 design in several ways. While the DayStar

has no on-board memory, the UMAX has 16MB of RAM soldered on the motherboard (total system RAM in our test unit was 212MB). Also, it has 8 rather than 12 memory slots, and therefore the RAM maxes out at 1.04GB. Like the DayStar, it features 512K of L2 cache.

As its name implies, the UMAX



The dual-processor UMAX SuperMac S900/250dp RAID and the quad-CPU DayStar Genesis MP 800+ are both powered by PowerPC 604e processors.

SuperMac S900/250dp RAID is equipped with two 250-MHz PowerPC 604e CPUs—currently the fastest version of the chip. Each CPU is on a separate board that plugs into a separate slot on the motherboard; the CPUs connect via a ribbon cable. This design allows the UMAX to be configured with a single processor and later easily upgraded to a dual-processor machine.

Although it has an integrated SCSI-2 adapter, our UMAX machine also had a UMAX-designed E100 Extended Performance card, which doubles as a SCSI controller and a Fast Ethernet adapter. This PCI card uses the ATTO Express Ultra SCSI chip set and supports Fast/Wide SCSI-3; it is matched with two 4GB Quantum SCSI hard disks configured in a RAID 0 array. Although you would typically stripe a disk subsystem to gain speed, on our PageMaker Place Pix test (which heavily taxes I/O performance), the DayStar with a single drive proved slightly faster than the UMAX with its dual drives.

More standard features of this Mac compatible include front and back sound input/output ports, modem and printer

ports, and two ADB ports. Our test system's graphics board was a Twin Turbo 128 with 8MB of VRAM.

DAYSTAR VS. UMAX

Given that these two systems are among the fastest Macs on the market, how do they stack up against each other in terms of performance? It depends on whether your tasks rely on floating-point or memory-intensive functions, cache memory, or combinations thereof. Our tests showed that except for specific MP functions and I/O-intensive tasks, the UMAX consistently performed slightly better than the DayStar.

Both units have specific speed advantages. The DayStar has four 200-MHz CPUs, while the UMAX has two 250-MHz CPUs, but increasing the number of processors creates an incremental—not linear—performance boost. Also, the vast majority

of software currently available for the Mac platform does not take advantage of multiple CPUs, which means that the computer is often running on one processor. The UMAX's faster CPU speed gave it a slight edge on some Photoshop filters and PageMaker tests that were not specifically optimized for MP operation.

THE BOTTOM LINE

The deck is stacked in UMAX's favor when you compare these systems, since the UMAX has more RAM, two hard disks, a better graphics board, and a software bundle of various utilities, all for \$1,500 less than the DayStar system. And although the DayStar's four CPUs make it slightly faster than the UMAX for MP-specific functions, until more programs are written to take advantage of the architecture, the UMAX is definitely the better buy. When compared with Apple's high-performance 9500 machines, both of these compatibles offer more for less money.

Given the state of Apple Computer today, should you buy into this platform? We wouldn't write this company off yet, despite sagging sales. Though

PCs continue to make major inroads, the Mac still dominates in the education, publishing, multimedia, and prepress markets. What's more, the Mac-compatibles industry is growing at breakneck speed, with companies such as Power Computing, APS, Everex, Akia, and others currently selling or planning to sell systems. Apple may be down, but it's certainly not out.—*Daniel Grotta and Sally Wiener Grotta*

Genesis MP 800+. Street price: \$11,500. DayStar Digital Inc., Flowery Branch, GA; 770-967-2077; fax, 770-967-3018; www.daystar.com. *Circle 452 on reader service card.*

SuperMac S900/250dp RAID. Street price: \$9,800. UMAX Computer Corp., Fremont, CA; 800-232-8629, 510-226-6886; fax, 510-623-7350; www.supermac.com. *Circle 457 on reader service card.*

Digital Equipment Corp.

Personal Workstation 433a

If you're planning to implement Windows NT you've got two choices for your processor platform: the Intel x86 architecture and Digital's Alpha RISC platform. With its \$11,300 street price (add \$2,000 for a 21-inch monitor) and its screaming performance on our Softimage and AutoCAD tests, the Personal Workstation 433a—based on Digital's 433-MHz Alpha 21164 processor—makes a great case in its favor. The only drawback is a lack of software support.

Native software application support is critical for the best performance of the very demanding applications found in the workstation environment. A cursory examination of our performance test results will verify this fact. For tests in which there were native Alpha versions of the apps available, the 433a performed significantly better than the other tested Windows NT machines (the dual Pentium Pro-based Compaq and HP workstations). Under AutoCAD, the x86-based Windows NT systems took almost 50 percent longer to complete the test than the Alpha did.

On tests where some cross-comparison was possible, such as Pro/Engineer, the Alpha unit was nearly twice as fast as the Sun unit and shaved a third off the SGI O2's timing. On the Softimage Men-

tal Ray Render test, the Alpha unit shaved almost 30 percent off the timing of its next-closest competitor, the HP Vectra XW. This kind of performance improvement is why users will purchase Alpha-based workstations; however, it's also their Achilles' heel. To get the most



Digital's Personal Workstation 433a boasts one of the speediest processors on the planet: a 433-MHz Alpha 21164.

out of an Alpha-based system, you need applications compiled for native Alpha code, and there simply aren't that many of these apps available. (We do not publish results for this machine on the PV-Wave and Photoshop tests, because the software has not been ported to the Alpha platform.)

Digital is addressing the lack of applications in two ways. First, like any serious microprocessor vendor, Digital is attempting to convince ISVs that there is enough of a market to make releasing native Alpha versions of their applications a paying proposition. Second, and far more interesting, Digital has developed FX!32 technology.

SOFTWARE: DIGITAL'S FX!32

FX!32 is designed to allow any 32-bit x86 Windows application to execute on the Alpha processor. It's not an emulator of the sort that's built into Windows NT, or of the SoftWindows type provided for the Macs or Unix boxes. Instead, it's three components that, working together, allow native Alpha instruction code to be derived from x86 application instructions.

FX!32 works as follows. The first time you run an x86 app, it's run in emulation mode. FX!32 watches the application run and tracks the information it needs about the behavior of the application. After you

exit the application, it runs an optimizer that creates native Alpha code to duplicate the actions taken by the application's x86 code. The next time you run the application, this Alpha code is run (rather than the x86 code), resulting in performance improvements that can be measured in orders of magnitude over the same app being run strictly in emulation mode.

Digital claims that a 500-MHz Alpha can execute applications using FX!32 up to the speed of a 200-MHz Pentium Pro. Unfortunately, the company wasn't able to provide a 500-MHz Alpha for this roundup; the 433-MHz product we tested ran 32-bit x86 tests at best at about half the speed of the Pentium Pro systems.

The biggest drawback of the process is that FX!32 can learn only the parts of the application that you use. This means that if, in a future session with the FX!32-enabled application, you use a new menu or function that wasn't used the first time around, that function will be handled by the much slower emulation mode; then the Alpha native code will be reoptimized when you exit the application. However, the application does allow you to import and export optimized profiles, meaning that if one or several people at the office have already gone through the process, they can share the optimized instructions with new users.

Digital also has a marketing problem with its Windows NT-based workstations. The company offers a full line of Alpha-based Unix workstations and a line of Windows NT and Unix multiprocessor Alpha servers, but the "a" series of workstations contains only the two current shipping levels of Alpha processor. Future growth for users who buy into this model will come with adoption of faster Alpha CPUs.

THE HARDWARE

By the time you read this, Digital's faster version of the 433a (the 500a) should be available. It will be the same system running the 500-MHz version of the Alpha 21164 processor that's found in our test system. This is the CPU upon which Digital is betting its future, having ported its

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midrange VMS operating system and its Unix implementation to this platform, as well as having made a huge investment in Windows NT development. The Alpha is a 64-bit superscalar microprocessor that uses many cutting-edge processor design technologies. Microsoft is developing the first 64-bit extensions to Windows NT 5.0 using this platform.

The rest of the 433a's hardware is relatively standard. The old-style mini-tower case (with an easy-to-break-off front cover) contains an assortment of off-the-shelf but very powerful and leading-edge peripherals, including an Adaptec 2940UW Ultra Wide SCSI controller hooked to a 2GB Seagate Ultra Wide hard disk. The machine supports up to 1GB of SDRAM in eight slots for the proprietary DIMMs. We tested with 128MB of memory (two 64MB DIMMs).

For graphics, Digital uses its Powerstorm 4D40T hardware-accelerated OpenGL and 3-D graphics adapter. This card is a licensed version of Intergraph's Real3D adapter (tweaked for Digital Alpha systems). It is designed almost entirely in custom silicon; in this version, it comes with 16MB of RAM split equally between frame buffer and Z-buffer. A 16MB upgrade of Z-buffer/texture-map memory is \$2,495 (list).

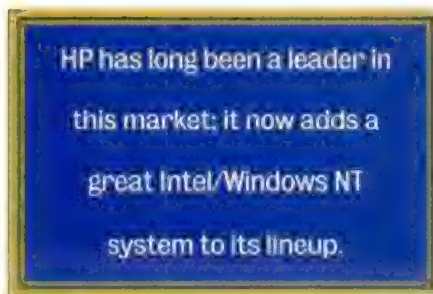
If you have a specific application to run and there is a native Alpha version of the app, you'd be hard-pressed to find a better-performing choice than the Digital workstation. But if you're planning on running primarily x86-based apps—no surprise here—you'll be better served by an x86-based system.—DC

Personal Workstation 433a. Street price: \$11,300. Digital Equipment Corp., Maynard, MA; 800-344-4825; fax, 508-493-7374; www.digital.com. Circle 453 on reader service card.

Hewlett-Packard Co.

HP Vectra XW 6/200

Hewlett-Packard Co. has long been known for building superlative workstation-class systems. But until recently, these machines were powered by HP's proprietary PA-RISC processor technology, running HP-UX, the vendor's Unix implementation. HP's workstation division still builds only PA-RISC sys-



tems, but some policy shuffling has allowed the PC division to release its HP Vectra XW 6/200, a \$10,874 (list) dual-CPU Pentium Pro system with workstation-class performance (add \$1,880 for a 21-inch monitor).

This scenario creates product positioning problems for the Unix workstation group. How does this group differentiate its low-end offerings from the PC division's high-end products, which offer equivalent performance at a lower price on an open platform? The biggest advantage that the PA-RISC systems have (like the Silicon Graphics and Sun units re-

breadth of peripheral hardware available. This is a very compelling combination of features for prospective buyers.

HARDWARE FEATURES

The Vectra XW is a relatively standard mini-tower system. Inside, most of its components are easily accessible, with only the processors covered by the power supply (which is attached with two large thumbscrews that allow the unit to slide out of the way easily). The system has twice as many memory slots as the Compaq Professional Workstation 5000 but supports the same 512MB of RAM (even though HP offers 128MB DIMMs as an upgrade option). The 128MB of RAM in our test unit came as eight 16MB DIMMs; if you need this much memory, we would suggest purchasing higher-capacity DIMMs, so you don't end up throwing away memory when it's time to upgrade. Unlike many systems that use DIMM memory, the XW's architecture requires that memory modules be added in pairs.



Graphics on the HP Vectra XW 6/200 can be displayed on the vendor's gorgeous new HP Ergo Ultra VGA 1600, a 21-inch monitor.

For networking, HP puts a 10/100 Fast Ethernet adapter into the standard configuration. You'll also find the usual complement of ports and connectors, plus standard Sound Blaster-compatible sound with front-panel jacks for headphones and microphone. Hard disk chores are handled by a 4GB Quantum Atlas II disk hooked to an Adaptec Ultra SCSI controller, which, while not the fastest subsystem in the test group,

viewed elsewhere in this roundup) is that in this price range, they are the entry-level models in a line of products that offer many different levels of performance, all with the same OS, thereby preserving the user investment in that class of hardware.

The advantages of the Intel-based Vectra XW are that it offers a better price/performance model, runs an OS that has a huge amount of developer support (as well as thousands of existing applications), and is a platform with a wide

still provided excellent performance. This performance is well illustrated on our Word Compound Document Load test. There, the HP and Compaq systems posted identical scores even though Compaq, using its Ultra Wide SCSI controller, claims a 100 percent increase in data-transfer rate over Ultra SCSI systems.

HP selected the AccelGraphics AccelPRO T/2500 3-D graphics adapter for use in the Vectra XW. This adapter uses the Glint 500TX chip set for hardware-accelerated 3-D support and offers a complete

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set of high-end application drivers for Windows NT. In our configuration, the board had 8MB of memory (VRAM) as a high-speed frame buffer, plus an additional 8MB (DRAM) for Z-buffer and texture mapping. The adapter provided double-buffered 24-bit color support at resolutions up to 1,152-by-870, at a 75-Hz refresh rate. It also offers a Heidi-accelerated driver specifically for 3D Studio Max, providing an additional layer of optimization for the 3-D modeling and rendering market that this class of machine is targeted toward. Full hardware acceleration is provided for the Windows NT OpenGL standard.

Two 200-MHz Pentium Pros with 256K L2 cache integrated are the heart of the Vectra XW. Keep in mind, however, that the current Pentium Pro is the end of this processor line. However, Hewlett-Packard workstations with Pentium II CPUs will be available later this year.

If you're planning to purchase the Vectra XW to run a specific application that does not support SMP, you would be better served to purchase the mid-level model, which also comes with 128MB of RAM and the OpenGL accelerator but uses the 200-MHz Pentium Pro with 512K of L2 cache. Spending the extra money on more memory, rather than a second CPU, would likely provide more of a performance gain. This is especially true with applications dealing with large, memory-intensive operations, like image editing and CAD.

PERFORMANCE

Our performance results show that the Vectra XW is at or near the top on almost every test. The system posted top scores on our PV-Wave Advanced Rendering Isosurface test, the Photoshop Gaussian Blur tests, and both PageMaker tests. This would indicate that the 200-MHz Pentium Pro is comparable in overall performance, including floating-point-intensive apps, with the RISC processors running in all of the non-Windows NT systems (as well as the Alpha CPU used in the Digital workstation).

This accomplishment is even more impressive when you consider that most applications don't deal well with multiple CPUs. Windows NT, however, is able to schedule tasks among the available CPUs



even when applications are not written to enable SMP. This means that well-threaded apps are able to see significant performance gains; even less well-threaded apps will benefit as the availability of other CPUs can move system housekeeping tasks off of the processor that is running the foreground application. While office automation software rarely shows significant performance gains between single- and dual-processor systems, real-world experience indicates that multiprocessor systems show their best in heavily loaded application environments.

The Vectra XW is an impressive system, providing competitive price and performance with other machines in its class. It is well designed, both from physical layout and system architecture perspectives, and would be a great choice for an entry-level workstation system.—DC

HP Vectra XW 6/200. List price: \$10,874. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; faxback, 208-344-4809; www.hp.com. Circle 454 on reader service card.

Silicon Graphics Inc.

O2 Desktop Workstation

Without the need to bind to any predefined architecture or to conform to computer-box design conventions, Silicon Graphics Inc. (SGI) serves up the most radical entry in our roundup, the O2 Desktop Workstation. This bluish desktop has a fun look and feel all its own. The system uses a modular internal design, which makes it a snap to upgrade. An impressive feature is its use of Unified Memory Architecture (UMA), which enables more with less and bypasses bottlenecks in 3-D processing.

If you're looking for a drag racer with raw muscle, other machines here may better suit your needs with more raw horsepower. This system performs more

like an Italian sports car: It might be beaten on the straightaway but not around the turns.

The O2 sets itself apart by being an all-inclusive solution rather than a single taskmaster. SGI offers seven different base configurations and four CPU options for the machine. Our review unit was a 64MB permutation of the Studio bundle (base price, \$9,900). To accommodate our testing needs, 128MB of RAM was added. This configuration weighed in at \$11,500 (the price includes a 17-inch monitor). SGI also offers the \$8,550 Webforce bundle for Web authoring and serving HTML and VRML content, and the \$8,100 O2 Modeler bundle for CAD (all street prices).

The Studio bundle is targeted at the 2-D and 3-D visual-content creation market. It hosts full support for video, and it includes a color desktop digital video camera and stereo audio. With a third-party adapter, you can modify the camera port to be a serial digital video port. Software includes Alias Wavefront Composer Lite 4.0.3 and Adobe Illustrator 5.5.1, among others. Network File System and PC-NFS 2.0.2 server components are also installed, along with a host of other applets for capturing, editing, and applying real-time 3-D effects to video.

The O2's hardware includes a 180-MHz MIPS R5000SC CPU with 512K of L2 cache, a 4GB hard disk, a 17-inch Trinitron monitor, and a quad-speed CD-ROM drive. An external SCSI floppy disk drive can be added as well.

All O2s—except for the most entry-level O2—are bundled with the IRIX 6.3 Web-integrated GUI OS, which sits atop Unix, and with Insignia's SoftWindows 95. On our tests, SoftWindows ran at about the speed of a 486/66 running Windows 95. Each O2 also comes with Netscape's Fast Track Server and Navigator, as well as Macromedia's Shockwave. The O2's connectivity package features Novell's NetWare Client and XiNet AppleTalk.

SETUP

When you first start the O2, you come to a screen that offers typical Unix log-ons. You can also log on as Out of Box Experience (OOBE), EZ Setup, and Demo, where no fewer than 25 demos of system

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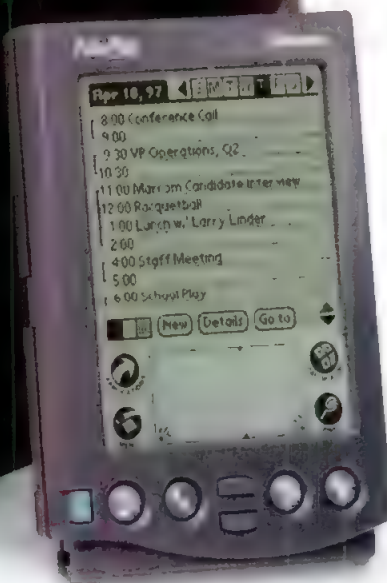
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COVER STORY
Graphical Workstations



SGI's radical O2 Desktop Workstation features a digital video camera and software for 3-D visual content creation.

features are accessible via an HTML Web-style interface or as desktop icons.

Choosing the OOBE launches you into a VRML 2.0 walk-through set to soft jazz. After a few clicks to take care of basic system settings, you're on your way to setting up security, network, and desktop customization options. When you're working under IRIX, a complete HTML help system is available.

Aside from the CPU, the O2 is based on four discrete chips. First is the MRE (memory and rendering engine), which handles the triangle setup and rendering phase of the 3-D pipeline. The second, the ICE (image and compression engine), handles real-time JPEG video compression and image-processing acceleration. Third is the IOE (I/O engine), an I/O controller. Last is the DE (display engine), which is capable of 32-bit double buffering and supports multiple open windows at different color depths simultaneously.

The MRE chip also handles dynamic memory allocations for the UMA. On most systems, a 3-D graphics board is used to accelerate 3-D graphics processing, as is the case with the other 3-D-enabled systems here. These boards have dedicated memory for double buffering, Z-buffer, and texture storage. Their designs are limited in that fetching bitmap textures to be rendered to objects in a 3-D scene requires crossing the system bus, thus creating a bottleneck. Under UMA,

system and graphics memory are more efficient, since they both share the same memory pool, and in addition, UMA's 2.1-GBps throughput keeps things moving at a fast clip. The need to produce multiple buffer copies is also reduced; if more memory is needed, it's there for the taking.

TESTING

The tests we ran were a valuable gauge of performance across a variety of graphics operations. Additional tests stressing more real-time 3-D operations may have been kinder to the O2. On our AVS tests (which measured real-time 3-D rendering), the

O2 managed only 5.3 frames per second compared with the leaders, which averaged around 12 fps. Given the other features of this system, however, the fact that the O2 was overwhelmed on some of our tests is not a point of major concern.

This disparity is partly due to the MIPS R5000SC's CPU, which fell behind faster competition. Also, the test didn't use large texture maps, which would stress the limitations of a fixed-texture memory space (found on other tested units) but would exploit the O2's UMA. The O2 was also outperformed on our 2-D Photoshop tests. It did quite well, however, on the PV-Wave tests because of the strong floating-point capabilities of the MIPS CPU.

THE BOTTOM LINE

The other systems here may have outperformed the O2 on our tests, but some are also at their performance ceiling from a platform perspective. What sets the O2 apart is that it is just the *entry-level* performer on the SGI platform. As SGI users need more horsepower, they can upgrade the O2 to an R10000 CPU or move to another SGI desktop like the Octane, which is the next system up the SGI food chain.

Should you need to create movie animation and special effects like those found in *Jurassic Park*, don't look to a Windows NT box: You can use the same application you started with on the O2 on

SGI's InfinteReality system (part of its Onyx series), or even move up to the Onyx2 RealityMonster, which features up to 16 MIPS R10000 processors, up to 8GB of RAM, and up to eight graphics pipelines.

What the O2 has now is similar to what the Mac had back in 1986 when PostScript and DTP were just coming to life on a desktop: *style*. The 3-D age of computing for the masses has just arrived, and the O2 is well equipped to tackle this new medium.—Jeff Mace

O2 Desktop Workstation. Street price: \$11,500. Silicon Graphics Inc., Mountain View, CA; 800-800-7441, 415-960-1980; fax, 415-961-0595; www.sgi.com. Circle 455 on reader service card.

Sun Microsystems Inc.

Ultra 1 Creator 3D Model 140E

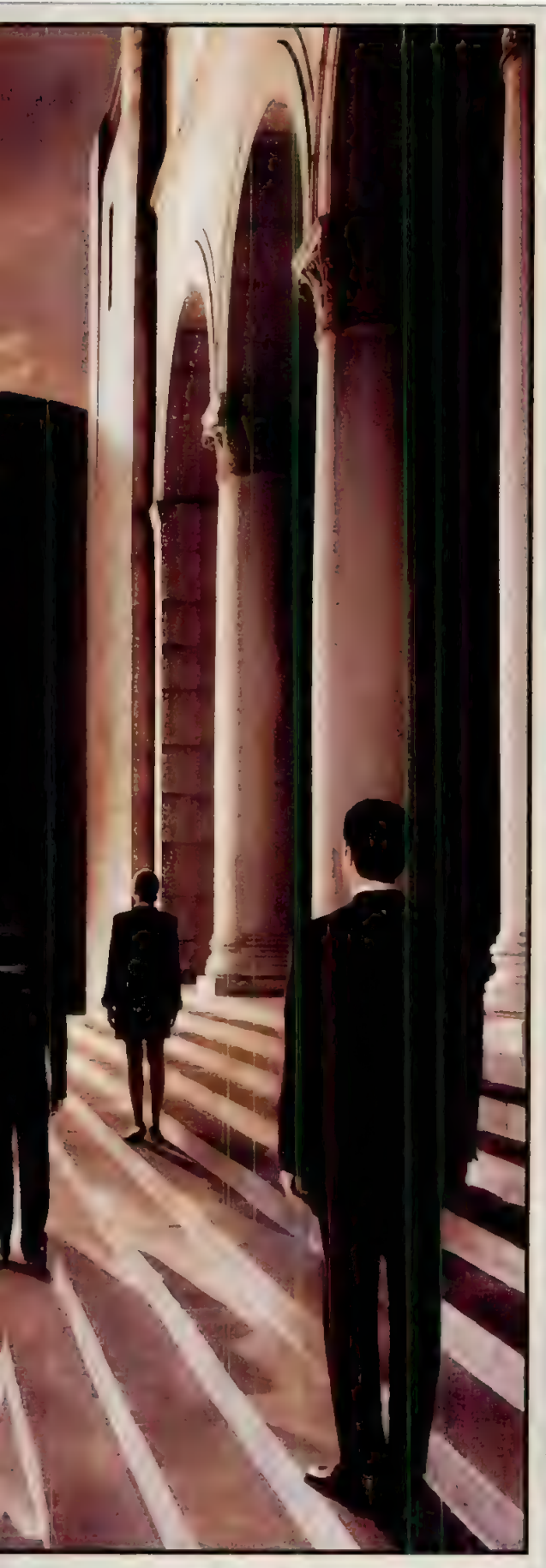
Since the 1989 introduction of workstations based on its Scalable Processor Architecture (SPARC), Sun Microsystems has been the undisputed champion of volume workstation sales. Setbacks occurred in the early nineties as SPARC processor designs started losing ground to newer, more advanced RISC chips from MIPS, IBM, and Hewlett-Packard. The 1995 introduction of the UltraSPARC CPU based on the 64-bit SPARC Version 9 architecture reinvigorated Sun and placed it squarely in the price/performance sweet spot once again.

At \$12,995 (list, including a 20-inch monitor), the slimline Sun Ultra 1 Creator 3D Model 140E incorporates a single 143-MHz UltraSPARC-I processor. Speedier configurations are available using 167-MHz and 200-MHz UltraSPARC chips, but both are priced in excess of \$15,000. The Ultra 1 series is positioned in the midrange of Sun's comprehensive workstation family, with list prices ranging from \$8,000 to \$22,000.

Lower-end systems include the SPARCstation 4, based on the micro-SPARC-II CPU, and SPARCstation 5, based on the TurboSPARC. Moving up the scale, the uni- and dual-processor Ultra 2 models list between \$21,000 and \$35,000. The high end belongs to the

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Ultra 3000 (1 to 6 CPUs) and Ultra 4000 (1 to 14 CPUs), with prices ranging from about \$45,000 to \$100,000.

SOLARIS OPERATING ENVIRONMENT

A key strength of the entire Sun workstation family is Sun's ability to maintain binary application compatibility among all products by using a common Solaris operating environment. All workstations can support applications built for the older 32-bit SPARC 8 architecture, although upcoming 64-bit applications targeted for the 64-bit UltraSPARC CPUs won't be backward-compatible with 32-bit SPARC systems. Literally thousands of Solaris/SPARC apps are available today for a variety of market applications. Sun is a leader in providing workstation solutions for engineers, scientists, financial analysts, software developers, and 3-D modelers and animators.

The Ultra 1 runs Sun's Solaris 2.5.1, providing both the OpenWindows GUI based on Open Look and the more recent CDE (Common Desktop Environment) GUI based on Motif. Solaris rides atop the Unix SVR4-compliant SunOS 5.5.1, and while the SunOS supports multiprocessing, Ultra 1 systems are limited to uniprocessor designs. Release 2.5.1 still has a way to go to be fully 64-bit-enabled, but portions of the disk subsystem are 64-bit today, as are certain integer math operations. A full 64-bit Solaris version isn't expected until mid-1998. Solaris includes extensive networking support for integration into corporate networks and the Internet, but configuring your workstation for networking can be a chore and is best left to network administrators.

SYSTEM FEATURES

Audio features were very easy to set up and use, with a high-quality microphone included for recording and saving audio files, which can be attached to e-mail or documents. The built-in speaker, while small, provided clear playback. Video playback off the CD-ROM drive slowed

down other system functions noticeably, however. The CDE desktop provided four separate full-screen workspaces at start-up to open a variety of applications and easily switch among them; it can provide a maximum of 64.

Sun offers a variety of emulation and coprocessor solutions for running x86 software in SPARC systems. We loaded Sun's Wabi, Version 2.2, with its latest patches. Wabi provides a Windows 3.1 emulation environment for casual use of x86 business apps. Unfortunately, we



Sun's Ultra 1 Creator 3D runs on an UltraSPARC-I CPU, the first CPU with multimedia-specific instructions.

were unable to get the 16-bit versions of Word and Excel loaded properly, but prior experience with Wabi on a 167-MHz Ultra 1 has shown it performs close to a 486 DX2/66.

Our Ultra 1 was outfitted with 64MB of RAM, 512K of L2 cache, a 2.1GB 7,200-rpm Seagate SCSI-2 hard disk, and a 20-inch 0.31-dot-pitch Sony monitor. Sun's powerful 24-bit graphics subsystem, called Creator 3D, is XGL- and OpenGL-compatible and includes 15MB of 3DRAM.

SIMMs are arranged in banks of two; eight SIMMs are installable for a total system RAM capacity of 1GB (using 128MB modules). The unit has four internal drive bays; one was used by the hard disk. The other three are specifically configured to accept another hard disk, an internal floppy disk drive, and either a CD-ROM

drive or a tape backup device. An optional external quad-speed Toshiba CD-ROM drive (\$300 list) was included with our test unit. Two 25-MHz SBUS slots are provided for expansion cards; ports include auto-sensing 10/100-Mbps Fast Ethernet, audio line-in and -out, headphone, microphone, SCSI-2, serial, and parallel.

The UltraSPARC-I CPU is at the heart of the system. It was the first processor developed with an entire suite of instructions (over 30) designed to accelerate multimedia processing. Like Intel's MMX instruction extensions, the UltraSPARC Visual Instruction Set (VIS) improves the performance of 2-D and 3-D image processing, real-time compression and decompression of MPEG-2 video streams, and video effects, to name a few. We believe VIS helped the Ultra 1 perform quite well on some of our Photoshop tests.

PERFORMANCE

Especially noteworthy are the Ultra 1's 288-bit-wide memory bus and the UltraSPARC Port Architecture (UPA), which is a high-speed crossbar packet-switched interconnect between the processor and memory. UPA allows peak memory transfers of 1.3 GBps. While the unit was not a stellar performer across all our tests, our results seem to indicate the UPA design was effective for our Photoshop Rasterize and PV-Wave mapping functions, which benefit from a fast memory subsystem. Also, the Ultra 1's graphics subsystem delivered strong results on the AVS Render test. As indicated in our analysis "What the Numbers Mean," when we installed 128MB of RAM in the Sun unit and ran our tests, we noted significant improvements under Pro/Engineer and some Photoshop functions that benefit from more memory. The 128MB configuration exceeds our pricing for this story; we provide the information for comparative purposes only. (All other systems had at least 128MB of RAM.)

The Ultra 1 is a highly integrated and balanced workstation with numerous impressive features for a reasonable price.

—Nick Stam □

Ultra 1 Creator 3D Model 140E. List price: \$12,995. Sun Microsystems Inc., Mountain View, CA; 800-786-3463, 415-960-1300; fax, 415-336-7512; www.sun.com. Circle 456 on reader service card.

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The PC Palette

As a tool for graphics professionals, the PC has long toiled in the shadow of the Mac. Now it's coming into its own.

Desktop Publishing

Comparisons of four perennial DTP packages.

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Image Editing

Reviews of seven programs in a rapidly changing category.

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Illustration

Evaluations of seven products for producing vector graphics.

Page 185

By Luisa Simone



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to discuss graphics
software with our
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Formidable as the PC is in so many segments of the desktop computer market, it still faces stiff competition in professional graphics, where the Macintosh has long been the platform of choice. But that's changing. The latest packages we reviewed for PC-based design professionals give the PC a whole new standing in this market. Across the three categories of products we surveyed—desktop publishing, image editing, and illustration—we found a wide range of tools with powerful features.

In the desktop publishing arena, the four familiar players have added compelling features in areas such as Internet publishing. Image editing is a less predictable, more crowded field, with seven products. Corel Photo-Paint 7 has evolved into a worthy challenger to Adobe Photoshop, while newcomers such as Wright Image offer promising new features. In the illustration market, we review seven packages for designing and publishing vector graphics, an area

getting more attention lately because of its suitability to the Web.

The boundaries between desktop publishing, image editing, and illustration are blurring. To a limited extent, DTP programs can mimic image-editing programs by applying filters to imported bitmaps. Image-editing programs now offer Bezier path tools similar to those in vector illustration programs. And illustration programs contain text-flow and formatting functions culled from desktop publishing programs.

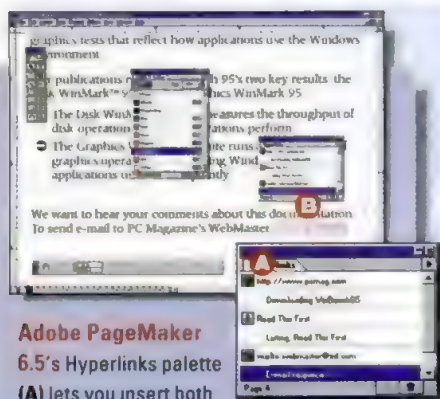
We saw a trend toward integrated graphics tool sets. Many of the applications reviewed here are also in suites, including the \$450 CorelDraw 7 (CorelDraw 7, CorelDream 3D, Corel Photo-Paint 7, and eight utilities) and Macromedia's \$450 Freehand Graphics Studio (Extreme 3D 2, Freehand 7, Macromedia xRes 3, and Fontographer 4.1). These prices are street prices. Micrografx Designer 7 and Picture Publisher 7 are sold only as part of the \$349.95 (list)

Micrografx Graphics Suite 2, which also includes FlowCharter 7 and Simply 3D 2.

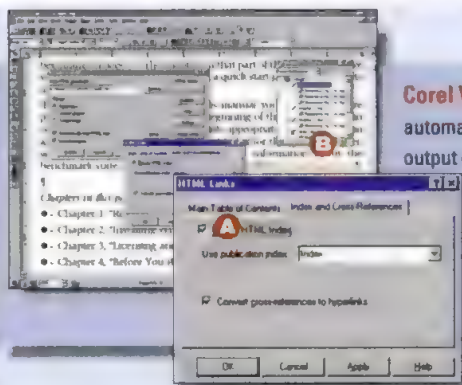
Graphics professionals don't like to be tied to one product line. They want to use whichever program is best for the task at hand. And they're more than willing to use two or more products in tandem, which can be complicated. It requires robust OLE implementations (to provide easy segues from one application to another) and industry-standard plug-ins. (Unfortunately, most program extensions are still brand-specific, as evidenced by Macromedia Xtras, Quark Xtensions, and Corel Scripts.) It also requires the ability to move high-level data—such as the multiple layers of an image-editing package, the custom tracking tables from a desktop publisher, or the multiple-color gradients of an illustration package—between applications. Too often, you still must drop to the lowest-common-denominator file format (such as TIFF, RTF, or editable EPS) to transfer files, losing advanced attributes in the process.

Graphics Tools for the Web

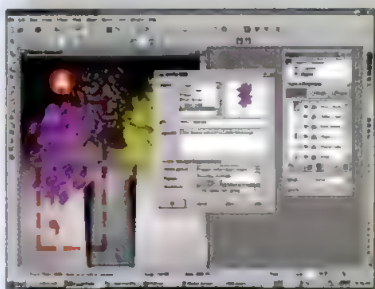
These days there's more to output than print. Graphics software is incorporating new features for designing images and documents for the Web.



Adobe PageMaker 6.5's Hyperlinks palette (A) lets you insert both internal navigational links and URLs into your documents with unparalleled ease. The outline-style listing shows you the relationship between the source and anchor. You can import URLs from an HTML document or from the Web itself. Best of all, simply clicking the Hand pointer in the standard toolbar switches you to a live preview mode where hyperlinks are shown surrounded by a blue box (B).



Corel Ventura 7 provides both automated and customized output options for HTML. For example, you can automatically map Ventura paragraph tags to HTML styles (A) but still retain control over the conversion of the index and cross-references to hyperlinks (B).



Corel Photo-Paint 7 makes it easy to define any image object as a URL hot spot (A). The dialog (B) offers access to all the objects in the currently active image, which is a time-saver. Then, when you save it as a JPEG or GIF, you can choose among client-side or server-side (NCSA or CERN) image maps.

Despite these lingering limitations, we found that PC-based graphics programs have matured. As a result, we have higher expectations—and more serious criticisms—of the market leaders. We were genuinely surprised by the number of supposedly stable products that generated problematic PostScript code on our tests—notably CorelDraw 7 and Corel Ventura 7. And some programs, such as Adobe Photoshop 4.0, need to cement their status in the market with new features.

We were also impressed with products such as Wright Image, Fractal Design Expression, and CorelXara 1.5, each of which takes a fresh approach to image creation. Even old standards offer new features—notably Freehand 7's drag-and-drop formatting, Adobe PageMaker 6.5's automated layout adjustment, and Photo-Paint's ability to switch between layer and object mode. All of this innovation means that the PC now has a lot more to offer the professional graphics designer. But the role of that profession-

al is expanding too.

Nowadays we call on graphics programs to do a lot more than prepare documents for print. With the rapid evolution of the Web's focus from text-intensive documents to design-intensive pages, graphics programs must provide robust electronic-publishing tools and file formats optimized for online viewing.

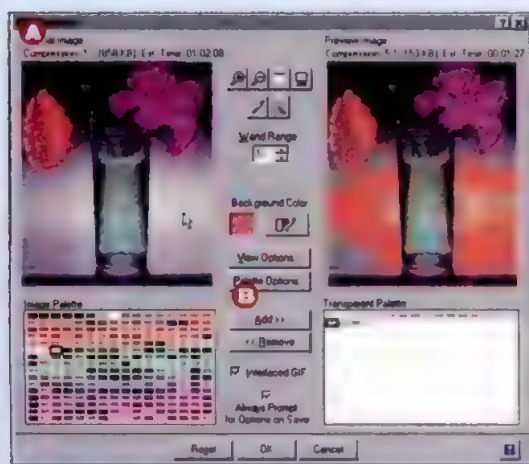
Thus we expected these packages to generate images as progressive JPEG and interlaced .GIF files or to convert page layouts to PDF and HTML formats. We weren't disappointed, but the products do differ in the thoroughness of their implementations. For example, PhotoPaint can export an image map (complete with URLs) along with a .GIF or JPEG image; other image-editing programs cannot.

These programs also exhibit true innovation in the form of new plug-ins—such as Adobe Acrobat's PDF format, Macromedia's Shockwave for Freehand, Corel's Java-based Barista, and Micro-

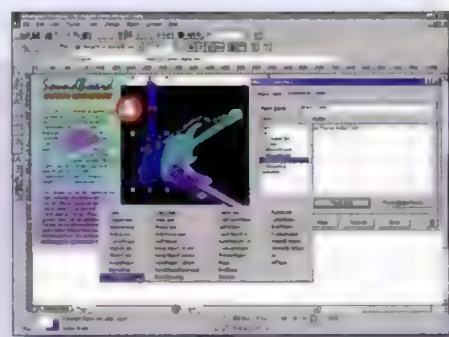
grafx's QuickSilver—that preserve a design's integrity, supporting features still beyond the capabilities of HTML. One surprising standout was CorelXara's Web format, which earned points for tiny file sizes, variable magnification levels, and fast redraws.

The graphics industry has been buzzing about device-independent color management. The truth is that Windows systems are still two steps behind the Mac when it comes to system-level color management. Kodak's Digital Science CMS (Color Management System), built into the latest versions of many products in this roundup, boasts device profiles compliant with the ICC (International Color Consortium) standard. But beware: Our tests proved that color management still isn't a point-and-click technology in the PC world.

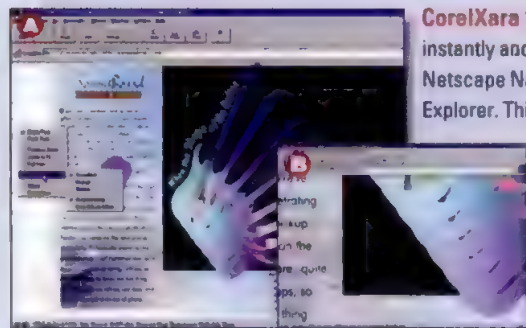
Finally, because the terminology employed by graphics professionals can be daunting, we've added a quick glossary to help demystify the subject.



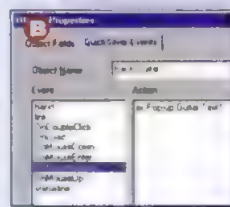
Picture Publisher 7's GIF save dialog offers a very nice array of options for preparing images for the Internet. Especially noteworthy are the before and after previews **(A)** and the ability to select and edit an array of colors for a transparency mask **(B)**. Another very nice Web feature in Picture Publisher is its Average Palette Wizard for batch conversions.



Micrografx Designer 7 lets you assign behaviors to vector graphics to create simple interactive applications for the QuickSilver browser plug-in. We

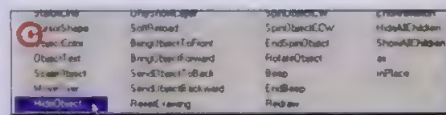


CorelXara 1.5 renders to any magnification instantly and beautifully with its plug-ins for Netscape Navigator and Microsoft Internet Explorer. This pair of pictures shows the same image in Netscape Navigator, zoomed out (A) and zoomed in (B) using a plug-in for CorelXara. On our tests, the plug-in rendered images on screen significantly faster than Macromedia's Shock-wave for Graphics plug-in.



selected an image of a guitar (**A**) and then used menu choices to make a text box appear whenever a user placed the mouse over the guitar (**B**). Another menu choice made the text box hide when the user moved the

mouse off the guitar **(C)**. You can even create animations. The result is a scheme that allows anyone to produce interactive Web applications easily.



A Guide to Graphics Lingo

Plug-ins and extensions have several uses. First, they allow vendors and third-party developers to add new features to an existing product. For example, you can use a plug-in to edit bitmapped images within PageMaker. Scripting extensions allow end users to automate repetitive tasks.

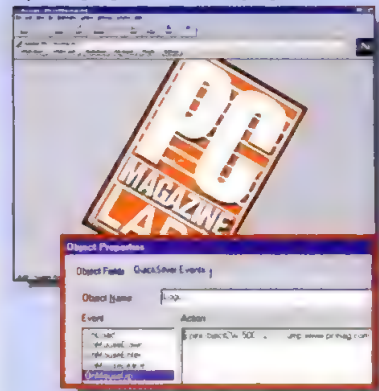
Image maps. When you are on a Web page and presented with an image that contains links to other URLs (also called *hot spots*), you are dealing with an image map. The picture itself is probably stored in the .GIF format. Associated with the .GIF file is an image map file. It contains coordinates, and those coordinates in turn invoke a URL. Ideally, a graphics program that claims to support Web graphics should generate not only the standard file formats (.GIF and JPEG) but also image maps so that you can assign URLs within the graphics program. Corel Photo-Paint was especially strong in this area.

Web plug-ins. Graphical browsers, such as Microsoft Internet Explorer or Netscape Navigator, can display raster graphics in .GIF and JPEG formats. If you want to display a different file format, or apply certain properties to a graphic not supported by HTML, you must use a plug-in to extend your browser's functionality.

Plug-ins such as Macromedia ShockWave, Micrografx QuickSilver, and CorelXara's plug-ins all allow you to view vector-based graphics within a Web browser. The advantages are that vector files should be smaller, download faster, and let the end user zoom in and out of an image.

Direct pixel editing versus on-demand (or proxy) pixel editing. In *direct* pixel editing, an entire raster file must be loaded into the computer's

Spinning logo viewed with plug-in



QuickSilver's properties box

memory. One pixel on-screen refers to one pixel in the source file. This is resource-intensive; it takes up a lot of memory, and it often slows down response time from the program.

On-demand pixel editing displays and loads only the pixels you need for the current magnification level. For example, if you zoom out to a 1:4 ratio, one pixel on-screen represents four pixels in the source file. As a result, the editing you are doing requires only a quarter of the resources. This speeds up response time.

Layers versus objects. This too has to do with file size and memory management. If you are in PhotoShop and you add a new *layer* in order to place one tiny brushstroke on the image, you must still use up the resources for an entire layer. The advantage of a layer is that you can paint or create objects on that layer without disturbing other elements in the composition.

An *object* implementation tends to use fewer resources. For example, it would let you create a pixel image that corresponded only to the exact size of the brush stroke—and would therefore consume only enough disk space and memory for that object. In most cases, when you apply or edit an object, it disrupts or changes some portion of the existing composition, because it doesn't reside on a separate layer.

Painting versus compositing. Painting is simply painting. You choose a brush, a color, and an application method, and you add marks to an electronic canvas. Brushes can be pressure-sensitive; they can add opaque or transparent color; and they can create effects such as blurring, smudging, or lightening. Compositing, on the other hand, can be thought of as collage. You take two or more source images and combine them.

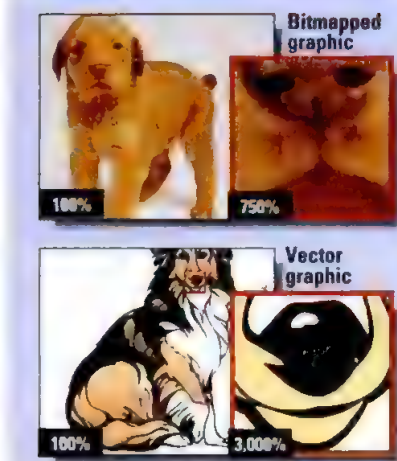


Image editing (bitmapped graphics) versus illustration (vector graphics). Inside a bitmapped image is a collection of *picture elements*, also known as *pixels*. Bitmapped images are resolution-dependent. This means that when you create a file, you must specify a resolution. When you change the resolution, the image becomes degraded.

The advantage of bitmapped (or raster) images is simple: They are ideally suited to representing realistic images such as photographs. They also can be transformed using image-editing filters to create a range of special effects and natural looks.

Vector illustrations, by contrast, store each image as a series of instructions on how to draw the object. Because drawing instructions are usually much simpler and can be highly compressed, vector files are usually much smaller than their bitmapped counterparts.

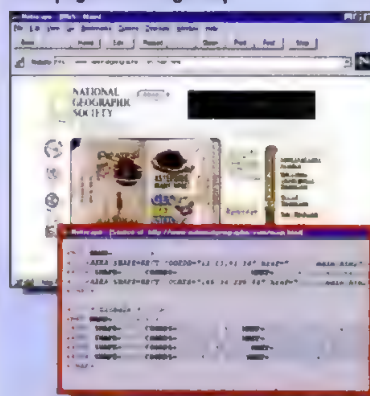
Furthermore, vector files are resolution-independent, because they are always rendered at the highest resolution the output device can produce. The biggest advantage of vector illustrations is that they can be resized without degradation.

Vector illustration programs also facilitate reformatting objects. This means you can take a blue square and quickly make it red, orange, or purple by changing its fill attributes.

In general, image-editing programs are designed for manipulating bitmapped images, and illustration packages are used to create vector graphics.

Plug-ins and extensions. Program extensions and program plug-ins extend the functionality of a program. For example, QuarkXPress can't generate a table of contents. But if you purchase a QuarkXTension, you can add that function to the program.

Web page with image map



Source code for image map



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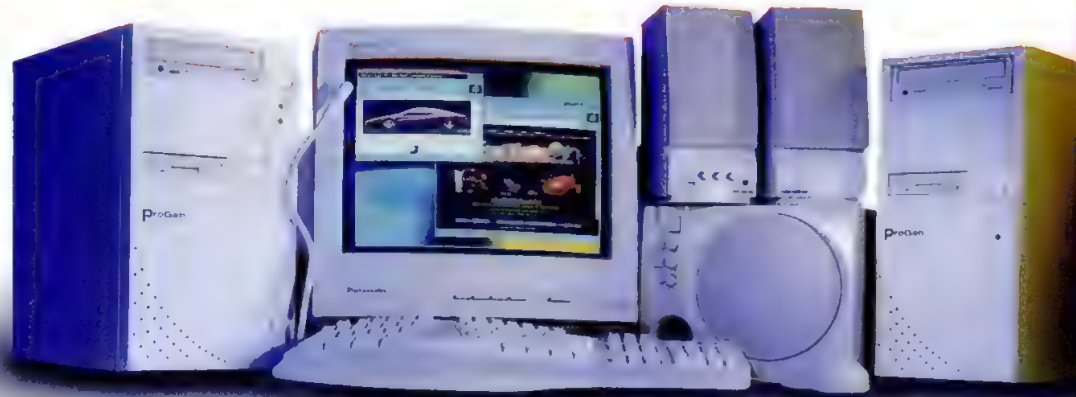
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Though the paradigms of the major desktop publishing players have remained basically the same, a closer look reveals programs that have taken decidedly new strides.



When we began testing desktop publishing software for this roundup, we hoped for nothing less than major changes. We did find that each product had retained its focus: Adobe FrameMaker 5 and Corel Ventura 7 continue to assign paramount importance to text flow and document-wide management features. Adobe PageMaker 6.5 and QuarkXPress for Windows, both still intrinsically page-based, continue to concentrate on design tools.

Overall, though, these products have redefined output in response to the growth of Web publishing. No longer are printed pages the sole fruits of desktop publishing products; they now also produce fully functioning HTML or .PDF documents. Chief among new functions are repurposing tools that let users readily reformat documents for different distribution methods—from paper

to Internet or intranet servers, for example. When converting a publication to .PDF or HTML, professionals now expect DTP programs to come with automatic conversion of table-of-contents and index entries to hyperlinks, plug-ins or scripts that extend the functionality of the product, and all the conveniences of the Microsoft Windows 95 and NT environments.

We were surprised, however, at how many things haven't changed about these programs. Only PageMaker has updated its color management engine to support the CIE Lab color space and ICC profiles. Both Ventura and Quark still rely on older proprietary systems, and PageMaker's composition engine still relies on plug-ins to create typographic effects.

As a result, the perfect desktop publishing program—the one product that can create both design-intensive documents *and* longer, content-driven documents—doesn't exist yet for the PC. But if you choose carefully, you'll get all the features you need.

By Luisa Simone

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Adobe Systems Inc.

Adobe FrameMaker 5

ALL REVIEWS BY LUISA SIMONE

Putting its own spin on the adage that form should follow function, Adobe FrameMaker 5 allows you to control both the appearance and the interaction of elements within a publication. It remains, however, a tool best suited for lengthy text documents rather than short, design-intensive projects.

On the PC Labs testing script, FrameMaker (\$895 list) proved repeatedly that its strong suit is managing content. You can build a lot of automation into a FrameMaker document with its robust tools for auto-numbering, cross references, conditional text, table-of-contents generation, version control, and indexing. For example, FrameMaker can track multiple series of autonumbered paragraphs, allowing you to generate compound page numbers (such as the folios referring to section, chapter, and page in our sample document) or to number elements, such as tables or figures, independently of one another. It generated both print and electronic versions of our content-driven document without a hitch. Using the book list, you can print either the entire tome or only selected chapters in sequence.

FrameMaker's sidehead paragraph

formats not only allow you to place text outside the main column, but also to specify the heading's position relative to other elements—aligning it with the first or last baseline or the top edge of the following text. Specifying custom rules and vertically centering text in a table were child's play for FrameMaker's Table Designer.

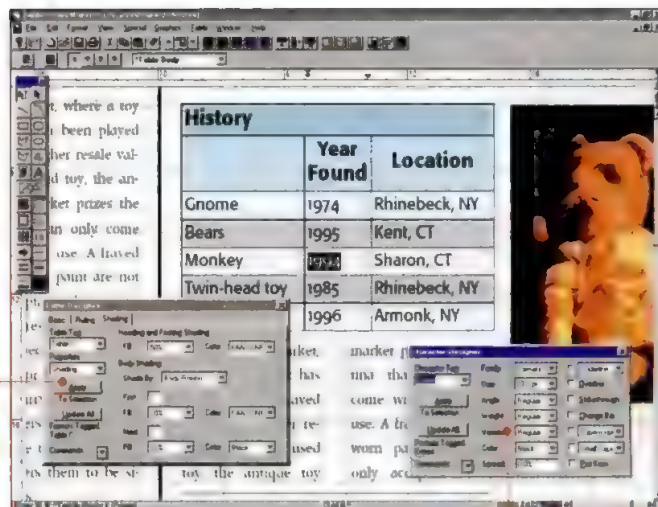
FrameMaker produced a visually flawless Acrobat file using the PDFwriter. To generate interactive Acrobat documents from FrameMaker, we produced

The Table Designer allows you to generate sophisticated tabular layouts, in which headings are formatted separately from body cells.

a PostScript file and ran the output through Adobe's Distiller module, which converts PostScript files to .PDF format. As you might expect from these sibling Adobe applications, FrameMaker supports many Acrobat features. Not only were cross references, index entries, and the table of contents preserved as live hyperlinks, but article

threads (based on FrameMaker's flow tags) were maintained.

We used Adobe's new HoTaMaLe export filter (a free download from the company's Web site) to generate an HTML document from FrameMaker. HoTaMaLe lets you map internal paragraph styles to specific HTML codes, and the ex-



ported HTML document preserves hyperlinks and assigned URLs.

Our principal criticism is that sometimes FrameMaker feels more like a programming tool than a design tool. Adobe needs to make FrameMaker's functions more accessible by adding drop-down lists and predefined elements. For example, continued-on lines should be a straightforward frame attribute based on the article flow tag. Instead, they are generated with standard cross references that you must define explicitly. Likewise, you shouldn't have to insert two cross-reference tags and manually type the Internet address in order to generate a hyperlink. Even creating something as simple as a paragraph rule is more difficult in FrameMaker than in other DTP programs.

FrameMaker isn't the right choice for design-intensive projects. It doesn't offer column or ruler guides, and without these familiar design aides, we were forced to determine the size and position of the individual frames in our test brochure using good old-fashioned math. The only automated part of the process

Using the Character Designer, we were able to assign an Expert font to numerical data without overriding the paragraph tag.

SUITABILITY TO TASK: DESKTOP PUBLISHING SOFTWARE



POWER

Layout	Fair	Good	Good	Good
Document production	Excellent	Good	Excellent	Fair
Printed output	Good	Excellent	Good	Good
Electronic output	Excellent	Excellent	Excellent	Poor

EASE OF USE

Layout	Fair	Excellent	Excellent	Excellent
Document production	Good	Excellent	Excellent	Fair
Printed output	Excellent	Excellent	Good	Good
Electronic output	Good	Excellent	Excellent	Fair

The **layout** rating involves a program's ability to create highly designed publications. **Document production** concerns the software's facility for assembling long publications such as technical documentation and books. **Printed output** involves a program's print quality based on the type of documents it's best suited for creating and how accurately a program matches colors. For **electronic output**, we assess how quickly and easily a user can repurpose print documents onto the Internet while maintaining their look and flow.

Most of our testing was done on Micron Millennia Pentium/133 PCs with 64MB of RAM, 2GB hard disks, Matrox Graphics' MGA Millennium graphics adapters with 4MB of memory, EIZO Nanao Technologies' FlexScan T2-20 20-inch monitors, and Wacom Technology's ArtZ II 6- by 8-inch graphics tablets.

was generating the actual objects by entering the values in the Customize Text Frame dialog box.

FrameMaker doesn't import CIE Lab, PhotoCD, or JPEG images. Without a third-party page-imposition utility, it can't print two facing pages on a single sheet of paper. We didn't generate four-color separations from FrameMaker, because it supports neither conversion of imported RGB images to CMYK nor automatic trapping. FrameMaker can generate separations from imported CMYK objects. But the program doesn't offer any color management features for producing accurate screen representations of the final printed output.

Adobe had an excellent reply to our queries concerning these shortcomings: Buy PageMaker. And indeed, PageMaker and FrameMaker concentrate on different ends of the desktop publishing spectrum. Within its own sphere, however—meaning the world of long, complex, highly automated, content-driven publications—FrameMaker is an excellent choice.

Adobe FrameMaker 5. List price: \$895. Requires: 386-based PC or better, 8MB RAM, 10MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Adobe Systems Inc., San Jose, CA, 800-843-7263, 408-536-6000; fax, 408-537-6000; www.adobe.com. *Circle 441 on reader service card.*

Adobe Systems Inc.

Adobe PageMaker 6.5



With its eye on the future of desktop publishing, Adobe PageMaker 6.5 has taken great strides in electronic publishing, full-color printing, and automated layout. In this \$895 (list) version, Adobe PageMaker has dramatically enhanced layout tools, which include frames, layers, and automated adjustments. All this new functionality adds up to stiff competition for QuarkXPress and earns PageMaker our Editors' Choice in the DTP category.

PageMaker's frames now can contain text or graphics. They provide functions such as vertical alignment or the ability to dummy a layout with placeholders. You can convert any PageMaker-drawn object

Editors' Choice

• Adobe PageMaker 6.5



Desktop publishing packages have always been used for

a wide variety of projects, from designing small newsletters to producing long, text-heavy documents such as technical manuals. No one program we looked at in this roundup excelled at everything. For most of the reasons people turn to these packages, Adobe PageMaker 6.5 is a good choice—especially if you typically create short, design-intensive publications.

With this version, Adobe has co-opted from competitor QuarkXPress some features that were previously impossible in PageMaker. This is most evident in its enhanced layout tools. For example, you can convert any drawn object into a frame, which can contain either text or graphics. You can create links between frames to control text flow precisely. For managing complex documents, PageMaker supports multiple layers, as well as multiple master pages. PageMaker was the clear



Adobe PageMaker 6.5

to a frame. And the links between frames give you much more control over noncontiguous text flow.

Borrowing an organizational technique from illustration programs, PageMaker supports multiple layers as well as multiple master pages. A dynamic relationship between the layers palette and the objects in a publication lets you manage complex layouts very easily. For example, when you select an element, its object handles are displayed in the same color that identifies its associated layer. Better yet, moving an object to a different layer is as simple as dragging the object's icon from the current layer to the target layer in the palette. And because you can turn layers on or off at print time, you can create different versions of a document. Nevertheless, this should not be confused with true conditional text as implemented in FrameMaker or Ventura.

winner on our paper output tests, and it is the only program we tested that supports CIE Lab images.

A new layout-adjustment feature automatically resizes and repositions page elements when you alter the file's page size or orientation, or apply a new master page. This last feature is particularly useful for repurposing documents for the Web. PageMaker's Internet features were slick. For instance, a hyperlink palette displays the source and destination of all your links, and a preview mode allows you to test them. The program even will attempt to convert multicolumn documents into HTML tables.

Our principal complaints about PageMaker were that its typographic engine is outdated, and that the program relies too heavily on plug-ins for tasks such as special effects. Also, PageMaker is not especially adept at handling long documents. It is in this area that Adobe FrameMaker 5 deserves honorable mention for its powerful automated content management features. If you need content management features but

don't have the time to learn to use FrameMaker, Corel Ventura 7 is worth considering. Finally, QuarkXPress for Windows remains one of the most powerful DTP tools available, but it lacks the automated content management and Web publishing features of competitors.

The new layout-adjustment feature is especially impressive. This automated function can resize and reposition elements whenever you change the orientation and page size of a publication, or apply a new master. Provided that you've adhered to a highly structured layout, the feature lets you easily convert page-based print publications to the horizontal screen layout necessary for Web publishing.

PageMaker handled all of our test images with aplomb. In fact, it's the only program in this roundup to support CIE Lab images—essential if you plan to generate HIFI or Hexachrome separations. PageMaker also had no trouble applying a special effect to an imported bitmap, thanks to Photoshop plug-ins that can be accessed from within a publication. PageMaker passed our process separation test with flying colors, producing the most efficient PostScript file in the shortest amount of time.

Much of PageMaker remains unchanged from previous versions. The core composition engine, for example, has not been upgraded. So you still have to generate typographic effects, such as drop caps or numbered lists, through plug-ins. They are effective but slower and less elegant than true paragraph formats.

In addition, PageMaker still does not allow you to edit kerning tables, and master pages are still

PageMaker's new Layers palette lets you better organize complex documents.

PageMaker 6.5 combines the program's traditional window-shade metaphor with Quark-like frames.

treated as static backgrounds—making it impossible to adjust a master layout on the fly for an individual page. The external table editor utility, which dates from Version 3.0, is a little worn around the edges. For the most part, PageMaker leaves document-wide functions to its sibling program, FrameMaker. The functions it does offer, which include book compilation, table-of-contents generation, and indexing, are inherently limited but blissfully simple to use.

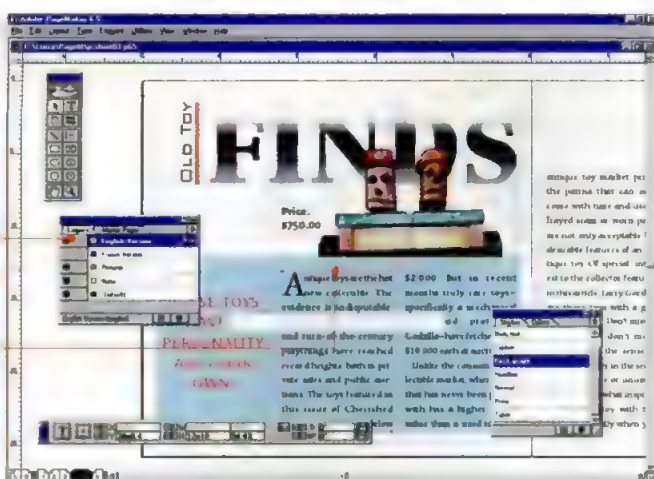
WEB WIZARD

PageMaker turned in a solid performance on the electronic publishing portion of our script. The program's new hyperlink palette shows you both the source and the destination of a link. Instead of tediously typing URLs, you can pick them up from your browser or by importing HTML. An easy-to-access preview mode lets you test the validity of your hyperlinks efficiently. HTML export is less robust. For example, you can't output a book file to HTML. As a result, only explicit hyperlinks (not table-of-contents or index entries) are maintained when generating HTML documents. PageMaker does earn a few extra points for attempting to duplicate a multicolumn layout using HTML tables.

Adobe has also tuned up PageMaker's interface with tabbed palettes

and right-mouse shortcuts. The bundled programs, Distiller 3.0, Adobe Type Manager 4.0, Photoshop LE, Type on Call, Adobe Table, and a QuarkXPress converter, are not mere window dressing but real workhorses.

Without an upgrade to the core typographic functions, PageMaker will have a



hard time wooing die-hard QuarkXPress fanatics. But the new layout tools and the robust electronic publishing functions may be impossible to resist. In our opinion, Adobe PageMaker 6.5 is a program that meets the needs of most traditional desktop publishers and anticipates the needs of most electronic publishers.

Adobe PageMaker 6.5. List price: \$895. Requires: 486-based PC or better, 8MB (for Windows 95) or 16MB (for Windows NT) RAM, 26MB hard disk space, Microsoft Windows 95 or Windows NT 4.0. Adobe Systems Inc., San Jose, CA, 800-843-7263, 408-536-6000; fax, 408-537-6000; www.adobe.com. Circle 441 on reader service card.

Notice that the clipping path (which should remove the background of the Twin toy image) does not display correctly in Ventura.

Sophisticated artistic effects, such as the radial gradient shown here, are literally borrowed from CorelDraw.

Corel Corp.

Corel Ventura 7

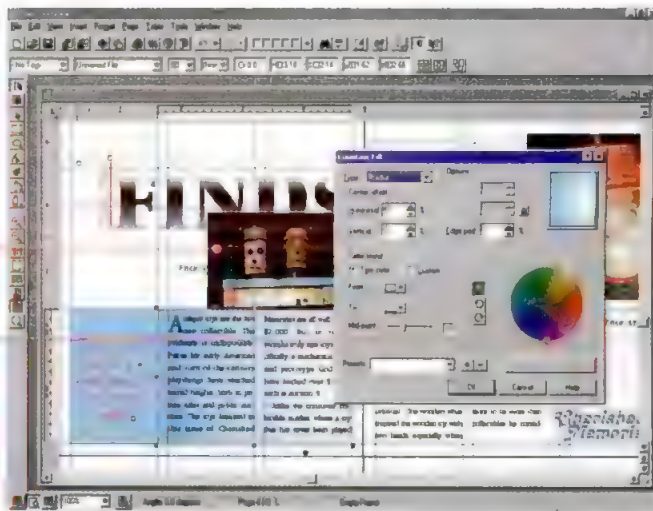
Corel Ventura 7 distinguishes itself by the sheer breadth of its features: It is the only program in this roundup whose toolset addressed all of the tasks in our testing script.

In this version, Corel has enriched Ventura (\$895 list) with a dizzying array of bundled applications, including Corel WordPerfect 7, Corel DataBase Publisher, Corel Capture, Corel Script Editor, Corel Photo-Paint 6, Corel CD Creator 2, CorelDepth, CorelMemo, Novell Envoy 7 Reader, Adobe Type Manager 4.0 Lite, a clip art library, and a font collection. It boasts artistic tools, such as a texture generator and multiple color gradients, not found in other DTP programs.

Like Adobe FrameMaker, Ventura is best suited for long documents. With automatic chapter and page numbers, headers and footers, table-of-contents generation, indexing, conditional text, and cross references, it still is one of the premier programs for that type of work. These powerful features are easier to access in version 7 thanks to a customizable interface that includes a modeless pointer to select frames, text, tables, and graphics; a new context-sensitive property bar; and extensive right-mouse shortcut menus.

DOCUMENT EXPLORER

Ventura's new Navigator tool can display lists of master pages, Corel Scripts,



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Source: PC World best overall PC company for reliability and service, December 1996.



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the table of contents or index, and a hierarchical view of the files in all open documents. By predefining and automating these features, Corel has made them easier to use, but also less powerful. For example, a Ventura cross reference can refer only to auto-numbered elements such as chapters or pages; it can't pick up text from a paragraph tag as FrameMaker can.

Ventura 7 also now includes multiple master pages that let you easily assign different layouts to document pages. New support for MDI (Multiple Document Interface) and Ventura Libraries enables you to drag-and-drop elements into your documents.

We found Ventura 7's layout tools to be flexible. For example, while Ventura—like FrameMaker—does not support automatic column guides, a Corel Script that ships with the program automates the process of creating and positioning those guides. Ventura performed well on our tests calling for editable kerning tables, vertical justification, balanced text columns, and automatic drop caps.

Ventura 7's color management engine is showing its age. While we applauded the accuracy of the color transformations when Corel's CMS first appeared, the fact remains that it does not support ICC profiles. The core CMS engine does not generate Hexachrome separations, instead relying on separate, tacked-on Kodak Precision Transforms. It does not support the wider gamut of CIE Lab images.

Ventura offers a number of electronic output options. Envoy output of the long, structured document (complete with TrueDoc embedded fonts) was perfect. But our test brochure was simply too graphics-intensive for the Envoy driver, resulting in six blank pages.

JAVA PUBLISHING

The current incarnation of Corel Barista, a Java applet that displays electronic documents, will preserve the page design of a publication (including characteristics such as multiple columns, footers and headers, and irregularly shaped graphics), but it won't preserve any hypertext links. Nevertheless, Corel guarantees that TrueDoc font embedding will work

SUMMARY OF FEATURES

Desktop Publishing Software

PC MAGAZINE
EDITORS' CHOICE

	Adobe FrameMaker 5	Adobe PageMaker 6.5	Corel Ventura 7	QuarkXpress 3.32
■ YES ■ NO				
Products listed in alphabetical order				
List price/Street price	\$895, \$550	\$895, \$550	\$895, \$600	\$895, \$570
Supports OLE 2.0	■	■	■	■
Extensible through plug-ins or scripting	■	■	■	■
Color management module/ICC compliance	■ ■	■ ■	■ ■	■ ■
Document Layout				
Master pages have live placeholders for text	■	■	■	■
Linked chapters in book	■	■	■	■
Anchored frames/User-defined page positions	■ ■	■ ■	■ ■	■ ■
In-line straddle heads/side heads	■ ■	■ ■	■ ■	■ ■
Text Handling				
User-definable tracking/kerning	■ ■	■ ■	■ ■	■ ■
User can edit tracking/kerning tables	■ ■	■ ■	■ ■	■ ■
User-defined hyphenation and justification	■	■	■	■
Automatic user-definable drop caps	■	■	■	■
Named character styles/paragraph styles	■ ■	■ ■	■ ■	■ ■
Automatic bulleted and numbered lists	■	■	■	■
Conditional text/table of contents/indexing	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Cross references/Automatic headers or footers	■ ■	■ ■	■ ■	■ ■
Vertical alignment and justification	■	■	■	■
Column balancing	■	■	■	■
Imports word processing stylesheets	■	■	■	■
Supports ODBC	■	■	■	■
Imports .WKS or .XLS files	■	■	■	■
Equation editor/language	■ ■	■ ■	■ ■	■ ■
Table editor	■	■	■	■
Maintains links to external text/graphics	■ ■	■ ■	■ ■	■ ■
Text wraps around irregularly shaped graphics	■	■	■	■
Text wraps around user-defined points	■	■	■	■
Text wraps within irregular frames or shapes	■	■	■	■
Text wraps around both sides of graphics	■	■	■	■
Graphics Handling				
Imports .BMP, .PCX, and TIFF files	■ ■	■ ■	■ ■	■ ■
Imports .CDR/.DRW/.EPS files	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Imports FlashPix/JPEG/PCD files	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Color Handling				
Fill patterns/Gradients/User-specified tints	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Color-mixing models	CMYK, HLS, RGB	CIE Lab, CMYK, HLS, RGB	CIE Lab, CMYK, Hexachrome, HLS, RGB	CMYK, RGB
Color-matching systems	Pantone	DIC, Focoltone, Hexachrome, Munsell, Pantone, Toyo, TruMatch	DIC, Focoltone, Hexachrome, Pantone, Spectramaster, Toyo, TruMatch	DIC, Focoltone, Pantone, Toyo, TruMatch
Bezier/freehand curve tools	■ ■	■ ■	■ ■	■ ■
Polygon and polyline tools	■	■	■	■
Output Support				
Black generation from RGB data	■	■	■	■
Specify halftone dot shape/angle	■ ■	■ ■	■ ■	■ ■
Specify halftone frequency per channel	■	■	■	■
Can convert spot colors to CMYK	■	■	■	■
Specify trap to any color/trapping amounts	■ ■	■ ■	■ ■	■ ■
Open Prepress Interface (OPI)	■	■	■	■
Electronic Publishing				
PDF/Enhanced PostScript output	■ ■	■ ■	■ ■	■ ■
HTML/Maps paragraph styles to HTML	■ ■	■ ■	■ ■	■ ■
Inserts URLs	■	■	■	■
Creates hyperlinks from table of contents	■	■	■	■
Creates hyperlinks from index markers	■	■	■	■

Best Consumer Digital Camera

(MacUser Eddy Awards, Jan. '97)

Product of the Year

(InfoWorld, Jan. '97)

Stellar

(Windows Sources, Jan. '97)



(ComputerLife, Feb. '97)



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That's it.

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Entry-Level Desktop Publishing Tools

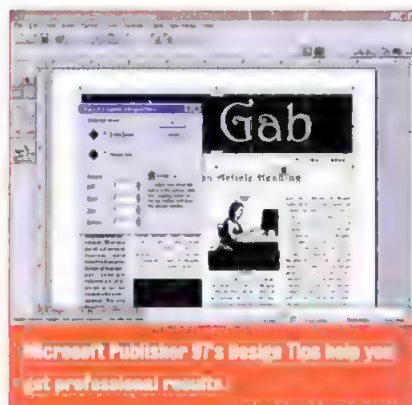
By Daniel B. Levine

Beginners balking at the expense and complexity of page-layout applications should first see if their word processing applications can handle the task. Many users can get by with the advanced features found in powerful word processors such as Microsoft Word and Corel WordPerfect. But don't be surprised if you eventually find yourself looking through the racks of your local computer store for another solution.

Many users get their first taste of publishing with Broderbund's *The Print Shop*. It seems as if you can't walk through a school or store without seeing the work of would-be Hearsts armed with Broderbund software (800-521-6263, www.broderbund.com). The company's soon-to-be-released *The Print Shop PressWriter* (\$40 street) offers more advanced functions for assembling stationery, flyers, newsletters, and multiple-page projects while keeping the same Print Shop interface already familiar to so many users. The software also includes a library of preset template layouts that users can switch to on the fly. Say you're building a brochure with a Southwestern flair and color scheme. PressWriter can completely reformat the page to an art-deco motif from a single command.

Artistically challenged people who

despair of ever matching their socks, let alone designing a full-color brochure, will want to keep their eyes open for a unique product called *i publish*, from Design Intelligence (\$150 street; 888-278-2547,



www.design-intelligence.com). This application lets users drag different data types—word processing, page layout, or image files—directly from Windows Explorer onto a page, which the software automatically arranges into a proper layout, based on rules developed by graphic artists. The software does more than just place your content into a preset template. It intelligently formats and reformats text and images based on the program's guesses of the relative importance of materials on the page. You can output the same document to HTML for publishing over the

separate frames.

Odd implementations and performance problems showed up throughout our testing. Ventura 7 still uses the older Corel 6 print engine. Not surprisingly, we had some problems generating four-color separations because the program generated large, unmanageable PostScript files.

Ventura's data handling capability is also a mixed bag. The ability to insert spreadsheet formulas into table cells is a great feature, but when Ventura imports a Microsoft Word document, it transforms the document's stylesheets into paragraph tag overrides. The result is a

Internet or the corporate intranet, though we saw the document lose many characteristics of its original design in the process.

Another outstanding product is Serif's *PagePlus 4*, from Allegro New Media (\$100 list; 800-557-3743, www.spco.com), which combines a number of higher-end functions, such as the use of Pantone color, and a nonsense interface with helpful tutorials, Wizards, and a huge library of clip art, templates, and fonts. One Wizard automatically formats pages for specialty paper available from PaperDirect for easy printing of professional-looking business cards, brochures, and certificates—without the expense or hassle of dealing with a commercial printer.

While PagePlus will easily grow with users as they advance from beginner to experienced status, *Microsoft Publisher 97* (\$80 street; 800-426-9400, www.microsoft.com) also excels with its combination of strong interface design, simplicity, and sheer power. Anyone familiar with the Windows interface will have few problems manipulating text and graphics. Wizards speed most tasks, from creating mail-merges to formatting and collecting a file for output at a service bureau or printer. Publisher 97 has that melding of ease of use and depth rare in the software industry.

Ventura document that looks like the original Word document but is difficult to reformat.

Corel's enhancements to Ventura 7 make it a viable contender. But, if Corel wants Ventura to be all things to all desktop publishers, it must guarantee that the toolset is reliable.

Corel Ventura 7. List price: \$895. Requires: 486-based PC or better, 16MB RAM, 65MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-3733; fax, 613-761-9176; www.corel.com. *Circle 443 on reader service card.*

in a Barista document only if you're using Netscape Navigator 2.02. In addition, all of the Barista object classes must reside in the same folder where you've stored your publication. These limitations make Barista more suitable for intranet, rather than Internet, publishing. Until the next version of Barista arrives, our advice is to stick with industry-standard file formats such as .PDF and HTML. Ventura preserved cross references, table-of-contents entries, and index markers as hyperlinks in the .PDF file we created. When creating the HTML document, we took advantage of Ventura 7's ability to place the hypertext table of contents and index in

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Quark Inc.

QuarkXPress for Windows

From the version number alone—which has increased only from 3.3 to 3.32 since our last roundup—you can tell that not much about QuarkXPress for Windows has changed.

On the plus side, that means QuarkXPress 3.3 (\$895 list) is the same powerful desktop publishing program. None of the design portions of our testing script posed a challenge for Quark: As long as you define desktop publishing narrowly—as the arrangement of words and pictures that are ultimately printed to paper or film—Quark performs exceptionally well. But when you step away from that traditional, design-oriented publishing model, the program begins to show its age.

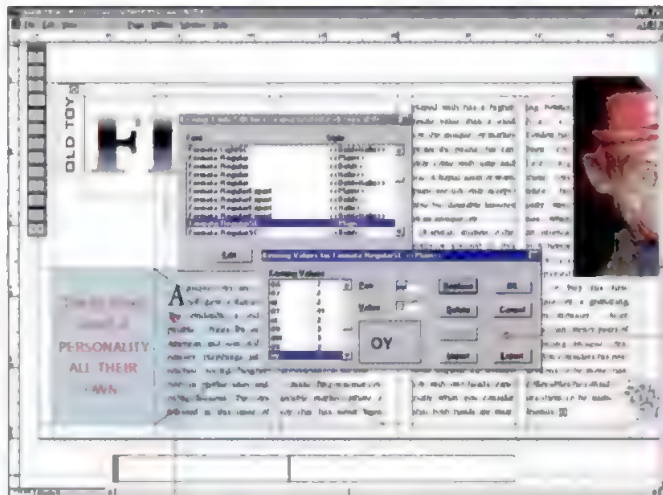
Quark still boasts precision layout tools, so it was easy to position elements using the numeric inputs offered by the Measurements palette, Quark's space and align functions, or the moveable guidelines. Copy-fitting text was a trivial task thanks to interactive tracking adjustments that can be made to any selected copy block. Likewise, Quark handled the necessary adjustments to the drop-cap effect in our sample brochure (which required both horizontal and vertical scaling as well as a baseline shift) without a hiccup. At several points during our testing, Quark's flexible tools allowed us to simulate design effects that the program doesn't explicitly support, including a format for sideheads.

PAGE MASTER

Quark also distinguishes itself with its implementation of master pages. The program's master pages are supremely easy to apply—just drag the appropriate master page icon from the document management palette onto a body page. And all elements on a master page remain live when the master is applied to a body page, so you can fine tune them as desired—unlike PageMaker, which uses static master pages. The program also provides a number of special effects, such as gradient fills and automated drop

caps, that can add drama to any design.

But when you step away from this design-oriented publishing model, Quark runs into problems. Many content-driven document management functions, such as an automatic table of contents, indexing, a table editor, and conditional text, are still outside of Quark's purview. If you want to add these functions to Quark, you'll have to purchase a third-party XTension—provided, of course,



Quark is at its best with traditional design tasks like the drop cap on our test brochure, but it lacks the content management features of Adobe FrameMaker or Corel Ventura.

that the XTension is available for the Windows platform.

Quark's color management engine—EFI Color—is no longer actively developed or marketed by Electronics for Imaging. The outdated SWOP profile

produced color separations of an RGB TIFF image with a visible color shift. And when creating a gradient from a solid Pantone color, Quark's conversion of the solid color to CMYK values was inconsistent because it bypasses the Color Management System. EFI Color doesn't separate RGB EPS images, directly support CIE LAB color space, or generate Hexachrome separations.

QuarkXPress for Windows stumbled on the electronic output portion of our testing: It doesn't let you generate an HTML file. By the time you read this, HexWeb (\$349 list; www.hexmac.com), a third-party XTension, should be shipping. But Quark won't directly support HTML any time soon, and the authoring tools in its proprietary online document

format, QuarkImmedia, unfortunately are still available only for the Macintosh.

.PDF PROBLEMS

Using the Acrobat PDFwriter printer driver resulted in an unreadable file that contained font substitutions and rasterized screen fonts. Quark confirms that the program sends screen font information to the PDFwriter printer driver. Increasing the Display DPI setting in the program's preference settings (Quark's suggestion) produced better but still unacceptably poor results. Quark's PostScript output, subsequently run through Acrobat Distiller, is the only way to generate a useable .PDF file.

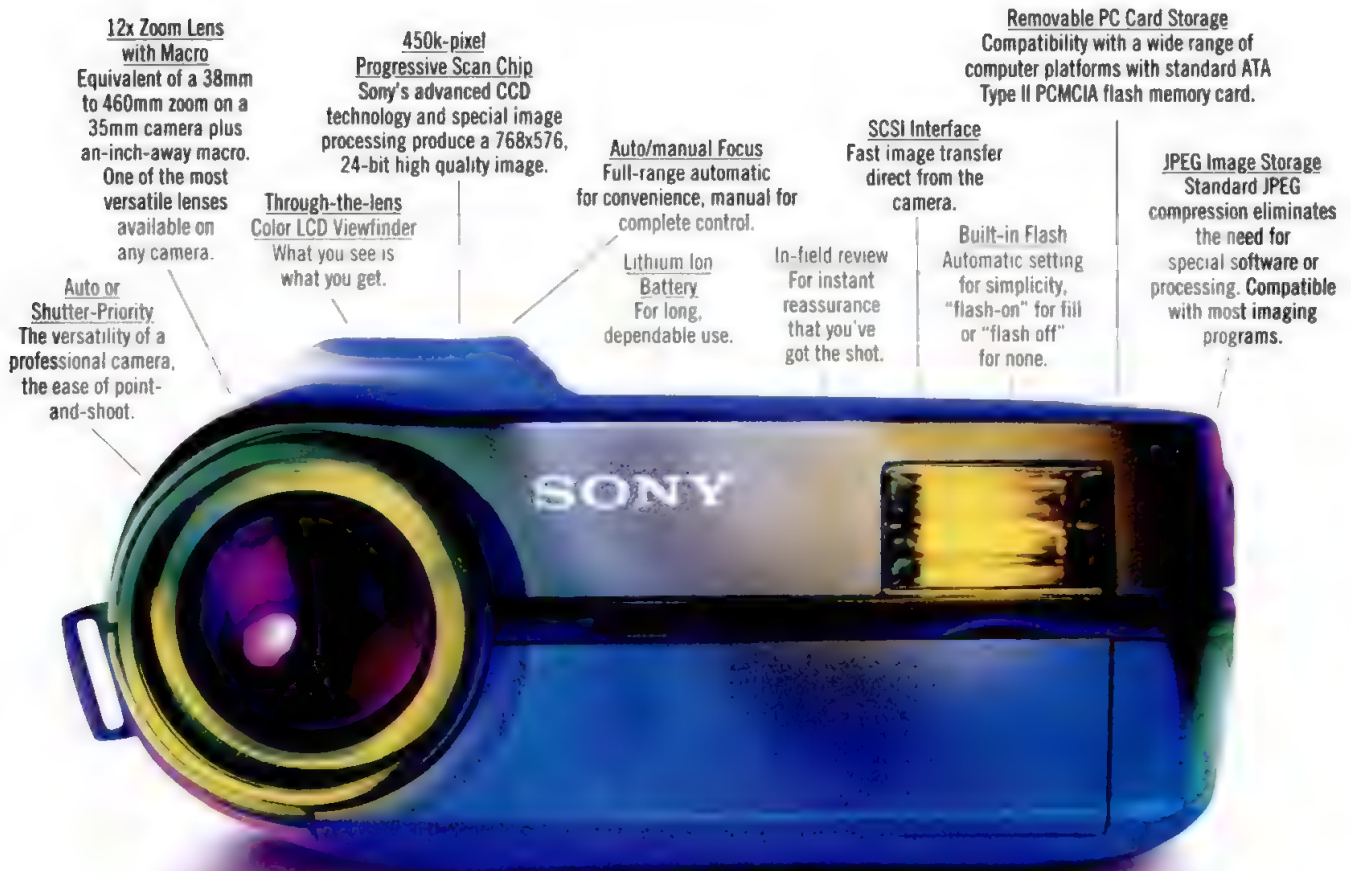
While many DTP programs allow you to adjust kerning manually, Quark's kerning pair editor allows you to adjust the automatic values for a specific letter pair in a specific font.

In addition to much better .PDF support, we have a list of features we'd like to see added to QuarkXPress: support for OLE 2.0, right-mouse shortcuts, the ability to set up dual printer drivers for proofing and final output, character-level formats, long-document features, and more robust import filters. The upcoming Version 4.0 promises several of the items on our wish list, including book compilation, automated table of contents, and indexing. In addition, Quark says it will add OLE 2.0 support and an industry-standard CMS that utilizes Colorsync 2.0 ICC profiles.

Promises aside, QuarkXPress 4.0 must demonstrate a commitment to the Windows environment. Windows users deserve the same broad range of XTensions and the same system-level integration enjoyed by Mac users. Right now, QuarkXPress 3.32 just seems to be visiting Windows; it doesn't really live there yet. □

QuarkXPress for Windows 3.32. List price: \$895. Requires: 386-based PC or better, 4MB RAM, 5MB hard disk space, Microsoft Windows 3.1 or later. Quark Inc., Denver; 800-676-4575, 303-894-8888; fax, 303-894-3399; www.quark.com. Circle 448 on reader service card.

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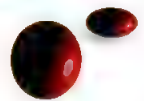
SONY



THE PC PALETTE

Image Editing

Desktop image editing is rapidly evolving. This year's professional-level programs offer a broad range of styles, tools, and features to meet the needs of artists.



he image editing market, once dominated by Adobe Photoshop, has become a free-for-all. The seven packages reviewed here deliver a range of professional tools and features.

Some make you choose between layers or objects, although Corel Photo-Paint 7 offers both. Others, such as Picture Publisher 7, provide unique methods for reediting images. They all come with different tools for linking complex files versus single independent files. But the most significant dividing line relates to the programs' structures. Some—such as Photo-Paint, Picture Publisher, Adobe Photoshop 4.0, and Fractal Design Painter 4.0—continue to use direct pixel editing. Others, such as Wright Image, have turned to on-demand pixel editing, which processes only that data necessary for screen feedback. QFX and Macromedia xRes 3 combine the two methods to get the advantages of both.

These Microsoft Windows 95

and NT programs all can edit and manipulate photorealistic (24-bit-color) pictures, and they output in both RGB and CMYK. We also paid close attention to new features for multimedia and Web output.

Our tests involved collaging, painting, color and tonal corrections, Web and print output, and OLE compliance. Our main criterion for the successful completion of a task was whether a professional artist working under a deadline would have been able to get the same job done. But we didn't forget about the joy that comes from working with tools that enhance creativity.

On-demand pixel editors are faster and more efficient, but they don't always offer the visual feedback of the direct pixel editors. An ideal program would combine both technologies in a single interface. Meanwhile, PC professionals may consider doing what their Mac counterparts have been doing for years: using a direct pixel editor for painting and correcting images and an on-demand pixel program for compositing.

*By Sally Wiener Grotta
& Daniel Grotta*

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Image Editing

Adobe Systems Inc.

Adobe Photoshop 4.0

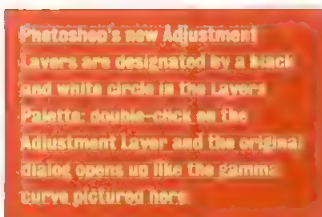
ALL REVIEWS BY SALLY WIENER GROTTA AND DANIEL GROTTA

An evolutionary—rather than revolutionary—update, Adobe Photoshop 4.0 offers few surprises. Instead, it incorporates many important and long-awaited additions. The result is a program that continues to maintain its position in the industry even though it is introducing technologies that have been popular in other packages for some time.

Photoshop (\$895 list) remains a direct pixel editor only, providing full visual feedback on edits. While Photoshop's layers offer the same flexible editing possibilities as other programs' objects, you'll find that file size expands significantly as you add layers, which eats up resources and can slow down processing and redraws. And the lack of objects means that Photoshop can't implement URL embedding.

QUICK TAKES

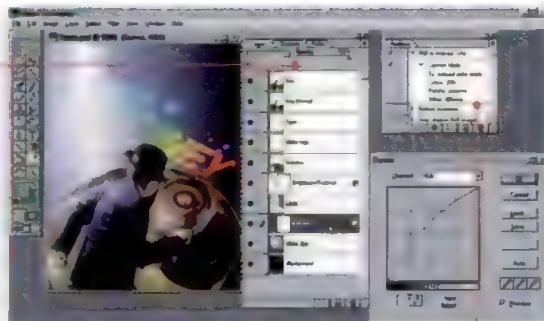
Adobe has boosted the speed of screen display and redraw in Photoshop, partly due to a variation of on-demand pixel editing. When you edit an image, Photoshop applies the edit to those pixels needed for screen display at the current zoom level.



We did not experience a significant delay in zooming when Photoshop applied the edit to another level of display. This improved display handling also lets you open a large file even if you are running out of memory. But if you have limited RAM, you may still have difficulty editing the file (ideally, the amount of RAM available for any direct pixel-editing program should be three to five times the file size of the image you're editing).

Photoshop still has only one level of undo, but it finally has a purge command. So, you can selectively free up memory that is being held by undo, the Clipboard, a pattern, or a snapshot. As a result, we no longer experienced the frequent freezes and out-of-memory messages that previously plagued large image-file edits.

Among the more exciting enhancements are Adjustment Layers, which can hold tonal and color changes. You can apply opacity levels and blend modes to these layers, control which underlying layers they affect, and paint gray-scale levels



Also shown is Photoshop's Actions Palette, which can record some edits and play them back. This feature can be a real time-saver by automating repetitive tasks.

to modulate the effect. Adjustment Layers don't add to the file size until you start painting on them.

However, when we copied and pasted a layer onto another image, the Adjustment Layers associated with it didn't move over with it. You have to merge the layers while pasting, which means that you can no longer edit the Adjustment Layers in the new image. We'd like to see a linking command that automatically brings in the layer and its associated Adjustment Layers onto the Clipboard and the new image.

CATCH-UP

Long-awaited and not necessarily innovative, Adjustment Layers and other

SUITABILITY TO TASK: IMAGE EDITING SOFTWARE

POWER

	Adobe Photoshop 4.0	Corel Photo-Paint 7	Fractal Design Painter 4.0	Macromedia xRes 3	Picture Publisher 7	QFX	Wright Image
Editing and retouching	Good	Excellent	Good	Good	Good	Fair	Fair
Compositing	Good	Good	Good	Good	Good	Fair	Excellent
Painting	Good	Good	Excellent	Good	Fair	Poor	Fair
Output	Good	Good	Fair	Fair	Fair	Poor	Fair

EASE OF USE

	Adobe Photoshop 4.0	Corel Photo-Paint 7	Fractal Design Painter 4.0	Macromedia xRes 3	Picture Publisher 7	QFX	Wright Image
Editing and retouching	Good	Excellent	Good	Good	Fair	Fair	Good
Compositing	Excellent	Excellent	Fair	Good	Good	Fair	Good
Painting	Good	Excellent	Fair	Good	Good	Poor	Fair
Output	Fair	Good	Good	Good	Good	Fair	Good

Editing and retouching Professionals need tools that go beyond the basics for controlling the tonal range of an image, including the ability to adjust brightness, contrast, hue, saturation, and the balance of image detail selectively.

Compositing Putting together a collage of images seamlessly is an art form. We rated the software's tools for creating and editing masks and alpha channels.

Painting Painting tools must be able to reproduce natural media brushes and effects as well as generate novel paint effects that can distinguish digital from traditional art.

Output We rated products for their ease of generating electronic and printed output, and the quality of that output. For printed output, our major consideration was color matching.

Most of our testing was performed on Micron Millennia Pentium/133 PCs with 64MB of RAM, 2GB hard disks, Matrox Graphics' MGA Millennium graphics adapters with 4MB of memory, EIZO Nanao Technologies' FlexScan T2-20 20-inch monitors, and Wacom Technology's ArtZII 6- by 8-inch graphics tablets.

changes basically represent Adobe's response to user requests. For instance, you can now perform all transformations (rotate, skew, distort, and scale) in a single interactive command set. And Photoshop finally has grids and guidelines. We were able to create absolutely straight horizontal and vertical airbrush strokes using the snap-to-grid option. But we had to turn off this option to get clean diagonal lines.

Photoshop continues to have the strongest set of prepress tools among the programs we reviewed. Photoshop also gave us the clearest and most precise desktop printouts. But unlike the other products in this roundup, Photoshop doesn't fully address the need for versatile, professional-quality Web and multimedia output. Photoshop's lack of support for image maps hinders its Web functionality. But it does a good job of color indexing to specific or user-defined color mapping tables, and it outputs to GIF89a, .PNG (Portable Network Graphics), progressive JPEG, and PDF (Portable Document Format).

With powerful tools for editing, manipulating, and collaging bitmapped images in creative ways, Photoshop remains the most popular professional photo editing program. But its lead in innovation in the image-editing market has eroded in the face of new competition.

Adobe Photoshop 4.0. List price: \$895. Requires: 486-based PC or better, 16MB RAM, 25MB hard disk space, Microsoft Windows 3.1 or later or Windows NT 3.51 or later. Adobe Systems Inc., San Jose, CA; 800-843-7263, 408-536-6000; fax, 408-539-6000; www.adobe.com. *Circle 441 on reader service card.*

Corel Corp.

Corel Photo-Paint 7



Once an add-on image-editing program created to fill out the CorelDraw graphics suite, Corel Photo-Paint 7 has suddenly transformed into a mature, robust, and fun-to-use professional graphics tool.

Corel Photo-Paint 7 (\$495 list) combines a full feature set with powerful user controls in a remarkably well-thought-out package. Essentially, Corel has created a direct pixel editor that does not force you to choose between creativity and produc-

Editors' Choice

• Corel Photo-Paint 7



Every once in a while, a new version of an applica-

tion comes along and surprises us. That's the case with Corel Photo-Paint, which once felt like a last-minute add-on to the popular CorelDraw graphics suite. But with Version 7, Corel Photo-Paint has come of age, incorporating most of the features of the image-editing stalwart, Adobe Photoshop, in a package that's actually fun to use.

In particular, we were impressed with Photo-Paint's ability to handle both layers and objects. Most programs use one paradigm or the other, but Photo-Paint gives you the best of both worlds. You can jump back and forth between layers and objects without any degradation in image quality. By using both objects and layers, you can, for example, apply brush strokes to an image. But because they remain independent of the image, you can edit these brush strokes at any time.

Corel is known for piling a lot of features into its products, and Photo-Paint is no



tivity, even if it does not deliver the lightning speed of on-demand pixel editors.

Photo-Paint has a traditional interface consisting of a toolbox, pull-down menus, and floating nested palettes (or roll-ups). As easy as the program is to use, the interactive Corel Tutor provides the best and quickest learning curve out of all the programs that we reviewed for this roundup.

Some programs (such as Photoshop) offer layers, while other programs (such as Picture Publisher 7) feature objects. Photo-Paint is unique in providing both objects and layers, with easy conversion between them from a single objects roll-up. Both compositing methods have pros and cons, however. Objects are more efficient than layers because they don't need to span the breadth of the image, but they cannot be easily expanded. In contrast, you can paint anywhere on a layer.

exception. Photo-Paint's tools, such as its tonal controls, are not only extensive but also versatile and intuitive.

Although the other image-editing programs have been slow to change, Photo-Paint is on the leading edge in terms of incorporating Internet publishing features. For example, Photo-Paint can export client- or server-side image maps (complete with URLs) along with a .GIF or JPEG image—something no other program in this category can do.

We had one minor reservation about Photo-Paint; although its print output quality was acceptable, it still could not match Adobe Photoshop in this area. While Photoshop still dominates prepress, Adobe needs to catch up with the competition in areas such as multimedia production and Web publishing.

A newcomer in this category, Wright Image deserves honorable mention for breaking new technological ground. It's not easy to get into because of its nonstandard interface, but Image is definitely worth the time it takes to learn. The program's strict parent/child

schema allows you to apply masks that are linked to a parent object but retain their independence for complete editability. Once Image gets over its growing pains, Version 2.0 has the potential to become the primary compositing tool in image editing.

The masks and alpha channels provide almost all of the power and editability that you would expect from a top professional program. But when you just want to make a quick gradient transparency so that one object blends into another, the new Object Transparency tool makes a previously tedious task incredibly simple. Similarly, you can use a Transparency brush for stroking local and very controlled transparencies onto objects. Unfortunately, once you click the Apply button, you cannot edit these transparencies. Such innovative tools would be even more valuable if they could convert the transparency information into alpha channels.

With its Repeat Brush Stroke tool, Photo-Paint lets you save a brush stroke that you've created in the omnipresent Property Bar. Then, using the Repeat Brush tool, you are able to draw a

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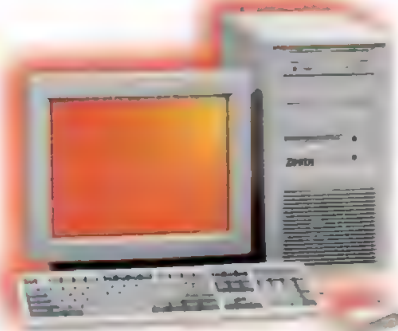
performance 200

- 200MHz Intel Pentium® Processor
- 64MB EDO Memory, Expand to 256MB
- 512K Pipelined Burst Cache
- 3GB EIDE Mode 4 Hard Drive
- 128-bit Lightspeed Video Card with 2.25MB MDRAM
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- 12X EIDE CD-ROM Drive
- 33.6Kbps FAX Modem
- Ensoniq Vivo 90 Wavetable Sound Card
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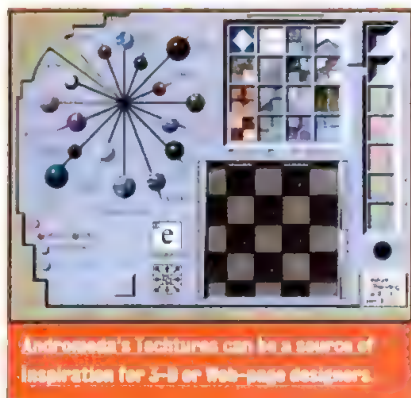
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Getting Plugged In

By Lori Grunin

The widespread adoption of Adobe's plug-in specification has resulted in a crop of one-size-fits-all special-effects filters. The crop of filters available for the PC runs the gamut from psychedelic effects to productivity tools.

Everybody's heard of Kai's Power Tools 3 (\$199 list; MetaTools, www.metatools.com), a must-have cornucopia of filters that definitely leans toward the funky. It lets you design outlandish spheres, generate algorithmic textures, and design multicolored gradient fills with varying opacity. It's



also great for creating buttons and backgrounds for Web pages.

Eye Candy 3.0 (\$199 list; Alien Skin Software LLC, www.alienskin.com) also ranks high on our list in the bizarre category. In addition to some great productivity-centered tools (drop shadows, bevels, and glass lenses), Eye Candy lets you jiggle and add hair to images, create stars, make objects glow, and generate motion trails. Eye Candy's tools are also



exceptional for spiffing up text.

Extensis concentrates on the bread-and-butter productivity-enhancing segment of the market. **IntelliHance** (\$100 street; www.extensis.com) puts all the important retouching tools (such as tone, saturation, and sharpness) in one well-designed dialog. The forthcoming **PhotoTools**, also from Extensis, is a toolbar customizer that includes beveling, embossing, and text-creation tools.

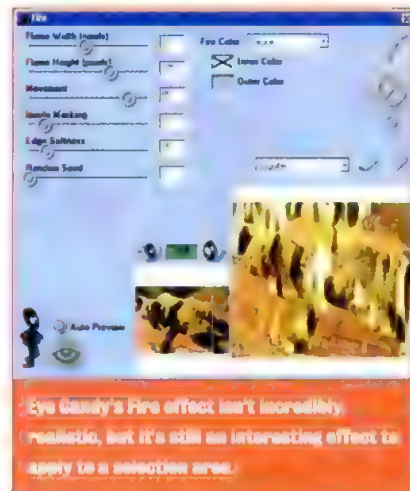
MetaTools' **KPT Convolver** (\$79 list) puts a pretty interface on an image-editor's convolution kernel (the internal ubermatrix that controls all special image operations). If you've got an artsy orientation, this one's for you.

Auto F/X Corp.'s **Photo/Graphic Edges 3.0** series (\$130 street each; www.autofx.com) provides a nice set of options in its Traditional, Geometric, and Artistic packages for enhancing the edges of images. Though the interface is a bit clunky, the program does automate an otherwise tedious manual process.

Less impressive than the rest of the crew, **Squizz!**, Version 1.5, is essentially

a ho-hum two-trick pony that performs brush and grid distortions (\$99 list; The Human Software Co., www.humansoftware.com). It's real-time response isn't fast enough for minute control, nor is its output quality as high as other filters. Squizz! is bundled with the standalone version of Corel Photo-Paint 7.

The Andromeda Filters (\$119 to \$159 list; Andromeda Software, www.andromeda.com) offers more of a mixed bag. We really liked the power and flexibility of Series 2, a 3-D filter that lets you map your selection onto a 3-D wireframe. The Series 4 Techures offer a fun way to add canned bitmap textures and environmental effects to images. The Series 1 Photography Filters, by contrast, are pretty ordinary.



And while the Series 3 Screens Filters provide powerful line-screen and engraving effects (predominantly from gray-scale images), the interface overwhelms you with confusing options.

bounding box in your image in which the brush stroke can be repeated as many times as you wish at user-defined variations of angle, size, hue, saturation, lightness, and so forth.

Photo-Paint also has a sizable library of easily customizable brushes. The color palette has numerous options. You can set it to display (or hide) which colors are out of gamut, color components, a mixing

area, color name, and more. The color models (all of which work with Photo-Paint's entire toolset) include RGB, CMY, CMYK, LAB, YIQ, or HSB.

One color feature actually suffers from a surfeit of options. To create a color gradient, you can use either the Gradient Fill tool or the Fountain Fill tool. The Fountain Fill tool is fully customizable, though it does have transpar-

ent colors. The Gradient Fill tool is based on already defined gradients, some of which include transparency. We believe that Corel should combine these two tools into a single nested dialog.

For Web production, Photo-Paint offers URL hot spots, with image maps that may be client- or server-side NSCA or CERN. Supporting both .GIF and JPEG (as well as many other file formats),



Photo-Paint is jam-packed with just about everything you'd want from a photo-editing program. And Corel has clothed it in an interface that assists rather than interferes with the creative process. **Corel Photo-Paint 7.** List price: \$495. Requires: 486-based PC or better, 16MB of RAM, 42MB of hard disk space, Microsoft Windows 95 or Windows NT 4.0. Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-3733; fax, 613-761-9176; www.corel.com. *Circle 443 on reader service card.*

Fractal Design Painter 4.0

When it comes to creative, individualized brushes and effects, Painter leads the pack. But even though Fractal Design Painter 4.0 (\$549 list) includes a few interesting new features and refinements, there is still room for improvement.

With its now-defunct ColorStudio software, Fractal Design Corp. was a pioneer in combining objects with bitmaps. But the text handling in its current product remains subpar. Painter converts text (though initially vector) into bitmap when you select Convert to Floater to apply transformations. After a couple of transformations on our tests, the type

Painter remains a one-of-a-kind program. Instead of competing with the other programs in this roundup, it complements them. It excels at providing the most creative tools for brushes and textures in any professional graphics program. But with Painter 4.0, Fractal Design could have



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SUMMARY OF FEATURES

Image-Editing Software



■ YES ■ NO

Products listed in alphabetical order

	Adobe Photoshop 4.0	Corel Photo-Paint 7	Fractal Design Painter 4.0	Macromedia xRes 3	Picture Publisher 7 (as part of Graphics Suite 2)	QFX 6.03	Wright Image 1.0
List price/Street price	\$895.00, \$550	\$495.00, \$350	\$549.00, \$380	\$599.00, \$400	\$349.95, \$330	\$795 (direct)	\$399.00, \$380
Direct pixel editor/On-demand pixel editing with rendering	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Painting and Drawing Tools							
Airbrush/Charcoal	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Crayons/Felt-tip pens	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Oil/Watercolor	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Pen and ink/Pencils	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Calligraphic line	■	■	■	■	■	■	■
Clone/Revert clone/Artistic clone	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
User can create/edit/save brush	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
User can specify pressure	■	■	■	■	■	■	■
User can specify transparency	■	■	■	■	■	■	■
User can specify rate of flow	■	■	■	■	■	■	■
User can create and edit patterns	■	■	■	■	■	■	■
User can create/edit textures	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Brushes can react to paper texture	■	■	■	■	■	■	■
Brushes can be set at different blending modes	■	■	■	■	■	■	■
Arcs/Circles/Polygons	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Freehand/Bezier/Spline	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Linear/Radial Gradient Fills							
User can define shape/angle	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can define center	■	■	■	■	■	■	■
User can define spectrum gradients	■	■	■	■	■	■	■
User can define multiple color gradients	■	■	■	■	■	■	■
Selection and Collaging							
User can save masks as alpha channels	■	■	■	■	■	■	■
Maximum number of alpha channels	24	Limited only by memory	1	32	1 per object	Limited only by memory	Limited only by memory
Multiple color masking	■	■	■	■	■	■	■
User can print transparency levels directly on the mask	■	■	■	■	■	■	■
User can specify opacity/blending mode of layer	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Layers/Layer palette	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Objects/Object palette	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Path to mask/Clipping paths	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Image Processing							
User can select/edit highlights	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can select/edit midtones	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can select/edit shadows	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Equalizing/Anti-aliasing	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can edit histogram/gamma curve by channel	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can edit histogram/gamma curve by whole image	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Indexed color mapping/User-definable mapping	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Text Handling							
User can cut, copy, and paste as text	■	■	■	■	■	■	■
User can style/fit to path/rotate text in real time	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Prepress							
User can specify CMYK channels independently	■	■	■	■	■	■	■
User can define/save ink	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
UCR/GCR setup	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Support							
Online tutorial	■	■	■	■	■	■	■
Free technical support by phone	■ (90 days)	■ (90 days or 30 days after first call)	■ (unlimited)	■ (90 days)	■ (30 days)	■ (unlimited)	■ (90 days)
Toll-free phone number	■	■	■	■	■	■	■

Image Editing

done even more to address the concerns of its users. It also could have dealt with some of the annoying limitations of the program.

Fractal Design Painter 4.0. List price: \$549. 486-based PC or better, 8MB

RAM, 20MB hard disk space, Microsoft Windows 3.1 or later. Fractal Design Corp., Scotts Valley, CA; 800-846-0111, 408-430-4000; fax, 408-438-9670; www.fractal.com. **Circle 444 on reader service card.**

Wright Technologies P/L

Wright Image

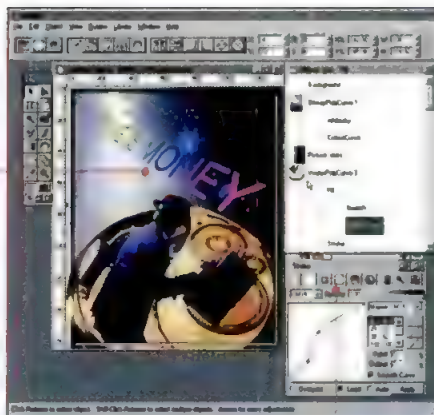
A revolutionary compositing program that uses parent/child object-based editing on photographs, Write Image definitely captured our attention. Without strong paint and Internet features, Image (\$399 list) is not yet entirely comprehensive, but it impressed us nonetheless.

This package uses a page-layout metaphor, so you can place objects such as photos and masks onto the page. The object may have a whole nesting of layered fills, including colors, photos, gradients, and so on. Fills, which are created using the Paint Style dialogs, are fully and individually editable children of the parent object. Interestingly, bitmap and vector objects, as well as those based in different color models, can coexist and interact on the same page. This is a far superior arrangement to xRes's and QFX's division of feature sets between vector and bitmap subprograms.

OBJECT-ORIENTED

Any object placed on a page comes with an initial silhouette mask that defines its shape and extent. So when we placed type in a collage, the silhouette defining that object was the outline of type. We filled it with an easy-to-design multicolor custom gradient, added perspective and distortion (without the resulting aliasing that was evident in other programs' bit-mapped text), and controlled it with a gradient mask so that the type appeared to

Every object in Wright Image can contain a nest of fills, commands, filters, and so forth. For instance, the watch in this picture is made up of a bitmap fill (the photo of the watch) and a tonal curve edit.



fade into the background.

By using the gradient mask, we were able to get a good sense of Image's power. The mask's angle, gray-scale structure, length, shape, center, and other defining elements always remained fully editable, independent of its parent object or other related children fills. Brush strokes, too, are object outlines that you can fill with anything.

Image has only six special effects: derivative, noise, sharpen, motion blur, smooth, and emboss. Although the effects dialog does provide versatility in color channels, blend modes, and transparency levels, there is no preview. (Wright Technologies contends that you do not need a preview to view changes as Image applies them.) In addition, Image is not fully compatible with Photoshop plug-ins. This further limits the number of special effects it could possibly have.

OUTPUT OPTIONS

Image uses proprietary file formats for its placed pictures and for its page layout. Conversion of EPS, JPEG, and TIFF files to Image's .DCM format is quick, and it creates a very useful thumbnail index. Image renders out a page as CMYK, RGB, or gray-scale to EPS, JPEG, TIFF, or Windows .BMP during the save process. Rendering may take a few minutes, depending on the complexity of the image. But in its native formats, Image creates links to all the original files and masks. This can eventually add up to become a library that's

To create either layers, you select the object, click on the plus sign in the Paint Style palette, and then choose one of the palette's various tabbed options. Each tab offers a full dialog.

hundreds of megabytes in size. These very specific path-defining pointers caused us some difficulty when we transferred our pages to a new computer.

Because Wright Technologies specializes in providing PostScript solutions for graphics workstations, its PostScript output is very well crafted. It includes controls over halftone frequency, angle, and dot shape, as well as the ability to create multiple or single-color separated files. Unfortunately, it lacks the necessary ink controls, UCR/GCR setups, and other functions for professional color output. In addition, it ignores nonprint output.

Wright Image is actually a subset of Wright's higher-end Wright Design (\$799 list), which was undergoing some revisions at the time of our testing. Version 1.0 of Wright Image is a promising newcomer with compositing power that's unique to Windows. None of the other programs we tested offer quite the same features as Image. With some enhancements, Wright Image could quickly evolve into a top-flight image-editing program.

Wright Image. List price: \$399. Requires: 486-based PC or better, 16MB (for Windows 95) or 32MB (for Windows NT) RAM, 4MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Wright Technologies P/L, North York, Ontario, Canada; 888-261-2261, 416-497-8388; fax, 416-497-4568; www.wrightna.com. **Circle 450 on reader service card.**

Micrografx Inc.

Picture Publisher 7

A mixed bag, Picture Publisher 7 has nice creative twists and a handful of powerful innovations, but it lacks the depth and follow-through that graphics professionals expect from state-of-the-art programs.

Picture Publisher (available only as part of the \$349.95 list Graphics Suite 2) is a direct pixel editor that uses objects rather than layers. The brushes are highly editable, but the results tend to look very much like those from a handful of basic brushes. Tonal controls and color editing are both comprehensive and easy to use. The special effects library is generous, with a single dialog through which you may apply and preview a series of effects. And among the plug-ins is



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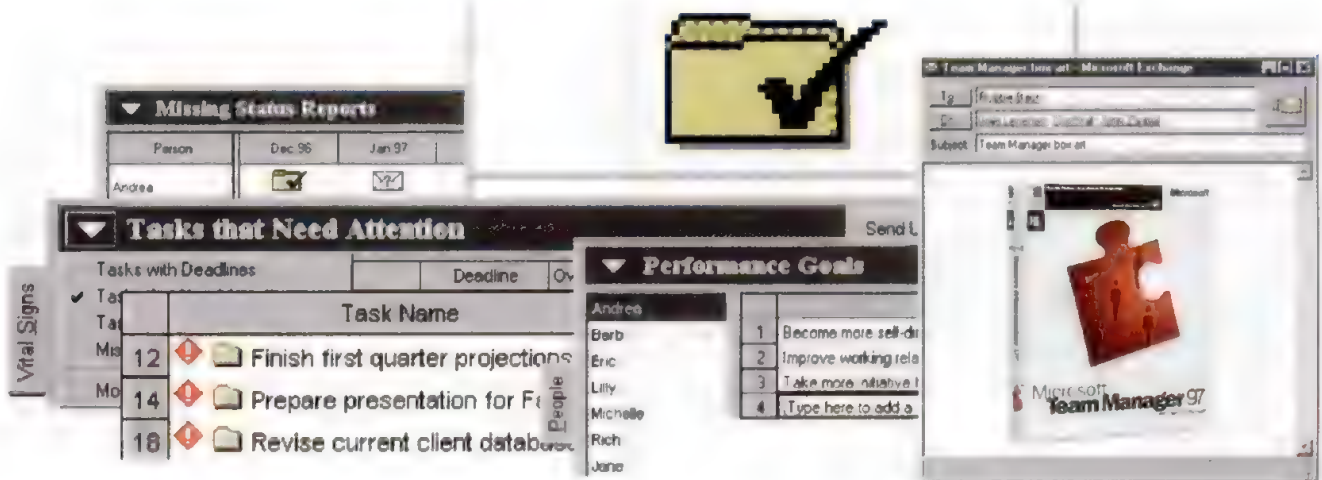
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Entry-Level Image-Editing Tools

By Daniel B. Levine

Although advanced color correction and exotic filters may excite the professional, home users expect image-editing software to be much like a point-and-click camera: inexpensive and easy to use. Now that the price of scanners and digital cameras has reached the consumer level—and some photofinishers offer film-to-disk service—a new category of applications called PC photography may become as ubiquitous on home computers as word processors and Web browsers.

Microsoft Picture It! (\$54.95 list; 800-426-9400, www.microsoft.com) shines when correcting colors. The application asks you to click on a white area in the image, and a built-in analyzer adjusts the color. Picture It! makes manual adjustments through a wheel, which you can spin until the photo looks right. Picture It! also has an excellent edge-finding algorithm, which helps you cut elements out of photos when assembling collages. Picture It!, Adobe PhotoDeluxe, and Live Picture's LivePix all ship with greeting card, calendar, border, and flyer templates for this purpose.

If you're mostly interested in creating images for a Web site, one alterna-

tive is **Microsoft Image Composer**, part of the FrontPage 97 Bonus Pack (\$149 list; 800-426-9400, www.microsoft.com). Rather than forcing you to learn masks, layers, and alpha channels, Image Composer uses graphics with shape, called sprites. You drag and drop sprites to build a composition. Image Composer



includes more than 600 images and 500 tools and effects. The program can even import Photoshop layers, and an add-on available at Microsoft's Web site (www.microsoft.com/imagecomposer) allows you to export images as animated .GIFs.

Adobe PhotoDeluxe (\$50 street; 800-888-6293, www.adobe.com) strikes the right balance between a simpler inter-

face and the power of Photoshop (from which much of its underlying code has been lifted). **MGI PhotoSuite** (\$149.95 list; 888-644-7638, www.mgisoft.com) and Ulead Systems' **PhotoImpact 3.0** with Web Extensions (\$199 list; 800-858-5323, www.ulead.com) take a more "baby Photoshop" approach; they come with a traditional photo-editing interface that grants immediate access to features without having to root through various wizards.

Unfortunately, for all the press about Live Picture's technology, **LivePix** (\$49.95 list; 800-724-7900, www.livepicture.com) runs rather slowly, and its interface may not appeal to everyone. A fully functioning demo is available for download on its Web site, so you can try it out before you buy it.

Picture It! and LivePix escort amateurs through the process of transferring their photos from the screen to a floppy disk in a format the one-hour photo shop will accept. In each case, it's the FlashPix format that Hewlett-Packard, Kodak, Live Picture, and Microsoft jointly developed. Picture It! can even e-mail files directly to Kodak, and it comes with vouchers for free processing.

the new industry standard, Digimarc Corp.'s PictureMarc, a copyright watermarking system.

CENTRAL STATION

Picture Publisher's most promising feature is the Command Center, which automatically tracks and records all edits that you do to your picture. You may group these edits into user-named folders, which may in turn contain other folders. As long as you save your image in the native ppf or pp5 format and check the correct options, the Command Center remains accessible for reediting at any time. You can even reedit objects that you have already merged into the background, which gives you the flexibility found in the other programs' layers and objects without the resource overhead.

But during our testing, the Command

Center didn't always work. We tried it on four different computers and a variety of images. Whenever some of our edits depended on and were preceded by a Select Object, only half the time did the replayed Command Center locate and then apply the edits to the correct object. Micrografx acknowledged the problems with the Command Center that we experienced during testing, but the vendor was not able to reproduce them.

Masking and selecting are almost excellent in Picture Publisher. With the Chroma Mask dialog, Paint on Mask tool, hard or soft feathering, and other tools, you can create a mask that is as close to perfect as humanly possible. However, each object can have only one mask. Also, Picture Publisher lacks a true Bezier tool.

Picture Publisher's wizards and macros

save you time and effort when you do normally complex tasks such as creating nearly seamless tiled backgrounds for Web pages. The Average Palette Wizard, for example, automatically creates an 8-bit palette for indexing a batch of 24- or 32-bit images. This wizard can save the images as .BMP, .DIP, .GIF, .PCX, or .PNG files.

WEB WAYS

Picture Publisher's color indexing is the best we've seen for creating 8-bit images that are nearly identical to the 24- or 32-bit originals, including some very difficult gradients. But it works well *only* if you've merged all the image's objects into the background. In other words, because Picture Publisher can't assign a URL hot spot to objects within an image, it doesn't let you create reeditable image

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We can't test your machine in our labs, so we'll send our benchmarks to you free of charge. Full programs, not demo versions. We want everyone to make the best buying decisions possible.

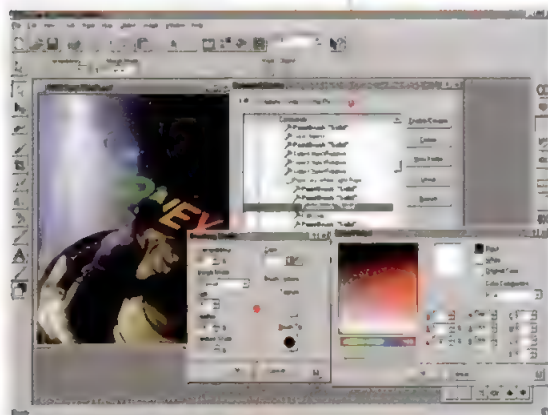
You can download the benchmarks from ZD Net/CompuServe (GO ZDBOP) or from our World Wide Web home page at <http://www.zdnet.com/zdbop>.

Or, for a CD-ROM (\$5 each for shipping and handling) fax your credit card information to 919-380-2879 or send a check to ZDBOP. Allow 4 to 6 weeks for regular delivery or enclose your FedEx number.

maps. (This review is based on the version of Picture Publisher found in Micrografx's Graphics Suite 2. Micrografx says that in their Webtricity suite, which should be available by the time you read this, Picture Publisher will be able to generate object-based URL hot spots and image maps.)

Still, Picture Publisher's Web support is generally good, with dialogs that provide considerable control over .GIF and JPEG options and previews. You can ex-

When you double-click on any bolded command in Picture Publisher's Command Center, you can edit the attributes of already merged objects.



port an image or individual objects with their masks to an HTML document. Under the Help pull-down menu, you can add to a list of favorite Web sites that can be accessed directly from Picture Publisher.

Here we're changing the color of a brush stroke—an example of Picture Publisher's editable attributes.

If you look at it one piece at a time, Picture Publisher 7 can appear outstanding. But when you need to work with Picture Publisher as a comprehensive package, you realize that the many small missing features—including thorough online and printed documentation—along with some annoying problems can make the difference between a superb program and one that's marginal.

Picture Publisher 7. List price: \$349.95 (as part of Graphics Suite 2). Requires: 486DX-based PC or better, 8MB RAM, 50MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Micrografx Inc., Richardson, TX; 800-676-3110, 972-234-1769; www.micrografx.com. Circle 447 on reader service card.

Ron Scott Inc.

QFX

Originally a program for professional photographers and digital artists, QFX remains somewhat of a niche product that focuses on photoproduction issues. It has some good features, but it's still missing key tools that have become standard among photo-editing programs.

QFX (\$795 list) is divided into two modes: Draw, which is vector-oriented for on-demand pixel editing, and Paint, which is bitmap-oriented for direct pixel editing. Although this division is not unique (xRes has a similar dual-mode setup), QFX does

not have xRes's near full-feature availability in both modes. For instance, the Draw mode has layers; the Paint mode does not. So when you go into the Paint mode to use brushes, you cannot place your work into separate layers for future editing.

DRAWING AND PAINTING

The Draw objects are powerful shapes that you can fill not only with color, gradients, or textures, but also with bitmap

images. Actually, that is how bitmaps are brought into the Draw layout: by filling an object with an image (from its file). If you need Paint-type edits on the bitmap-filled object (for example, brightening the mid-tones), you simply edit the image file in the Paint mode, then click on the update button for the bitmap object in the Draw layout. When we used this feature to edit a photo of a watch that we had already placed in the Draw mode, we were pleased to see that the object retained all of our earlier positioning edits.

QFX's masking options are quite extensive, but you can associate only one mask with any bitmap. Nevertheless, QFX allows you to save masks as independent files that any image can use, and you can edit them in the Draw mode as any grayscale image. In addition, you

QFX's brushes are very nonstandard, but their options include a variety of uses of the brushes: alpha channel.

can use Boolean-like functions to combine masks. When you fill a Draw object with a bitmap, you can then choose to use its associated mask.

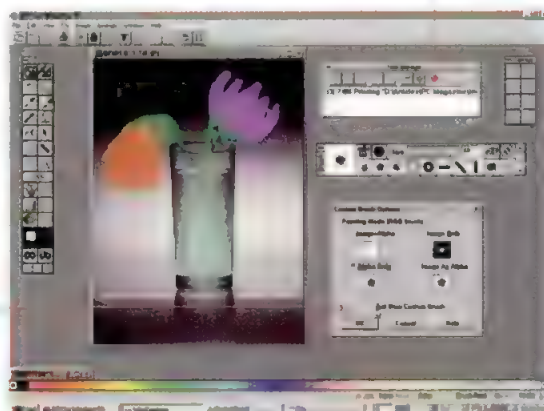
Brushes are resolution-independent 32-bit images. In fact, you can define any image or part of an image (and its mask) as a brush. We used QFX's brushes to apply filters, tonal changes, and other effects for precisely controlled, highly creative local edits and special effects that are not available in the other programs.

PRESENTATION

For editing very large high-resolution images, QFX paved the way and continues to excel in this area, offering options that sometimes make the program seem more responsive than other programs when performing the same tasks. For example, QFX's "Intelligent Virtual Memory" (which works better in Windows NT than in Windows 95) swaps data in 250K chunks rather than in 4K chunks. The Fast Open option does not place the image information into RAM until you start editing it. And when you save to the original file rather than to a backup, QFX writes only the changes you made instead of writing the entire picture.

QFX is print-oriented and has no Web or multimedia utilities. More significantly, we were very disappointed with the poor gradient reproduction in our desktop dye-sublimation printouts. In addition, neither the Draw nor the Paint mode has a perspective tool or any orientation commands. But Paint does have

Also pictured is the Task Manager, which controls the flow of print jobs and other tasks, giving you the ability to prioritize, halt, and push forward what you need to do first.





PROJECTING A BETTER IMAGE: VOLUME ONE

'The mind is a wonderful thing.

*It starts working the minute you're born & never
stops until you get up to speak in public.*

'Roscoe 'Drummond

*What if my mind goes blank in the middle of my speech?
What if my audience thinks I'm boring?
What if my voice trembles and I start stumbling over my words?
That nervous fear of speaking before a group is not only common, it's completely natural.
Even people who conduct*



seminars on public speaking get nervous. Yet just because your knees are shaky doesn't mean your presentation has to be, as well. Just by using the suggestions outlined here, you'll be better able to control your nervousness and become a more effective public speaker.

You're giving another speech. Is that your audience applauding? Or the sound of your knees knocking?

Feeling at ease with an audience of 5 or 500. Nervousness makes your body act as if it were preparing for a strenuous physical activity. The adrenaline that's released makes your heart beat faster, causing you to take in more oxygen. But more oxygen just makes you feel more nervous, so your body releases more adrenaline. Even though you'll only be speaking, you now have enough energy to run a marathon. Somehow, you need to control this physical process. Here are 3 simple ways to help you do that.



To relieve tension, pull up on the bottom of your chair for five seconds. Repeat often.



Pressing your palms together tightly also relieves tension. You can even do it during your presentation.



Force yourself to breathe slowly and deeply. This slows a rapid heart rate caused by too much adrenaline.

10 WORST HUMAN FEARS IN THE U.S.

1. Speaking before a group
2. Heights
3. Insects & bugs
4. Financial problems
5. Deep water
6. Sickness
7. Death
8. Flying
9. Loneliness
10. Dogs

Source: The People's Almanac
Presents The Book of Lists

YOUR MIND IS THE MOST POWERFUL WEAPON you have for controlling fear and nervousness. In fact, experienced speakers have ways to actually outsmart their nervousness so that it doesn't get the best of them. With the following tricks, you can do it, too.

Practice makes perfect.

Mark Twain said it usually took him three weeks to write a really good impromptu speech. We have no doubt that he spent much of his time practicing.



All the more reason to start rehearsing as many days before your speech as you can. Also, be sure to practice in the room where you'll be speaking. Doing both of these will make you decidedly more confident and persuasive.

Make friends, not enemies.

If possible, try mingling with your audience before



you give a speech. It sounds

silly, but it really can have a wondrous effect. When you finally do stand in front of your audience to

speak, you will no longer see them as your enemy.

Memorize the beginning.

People are often most nervous at the start of their presentations. So simply memorize the first couple of minutes. After you get past the



introduction and into a good cadence, you may be surprised to discover that your stage fright will have all but disappeared.

Redirect your thoughts.

Instead of thinking about audiences as a reason to be nervous, think of them as a source of comfort. Your audience is there to

hear what you have to say. So relax. After all, to everyone listening to you speak, you're the expert.

Make cheat sheets.

To avoid worrying about covering all your points, and to help you present those points in the order you intended, write the first few words for each subject on a 3x5 index card. Use one card per topic in your speech.

Get there one hour early.

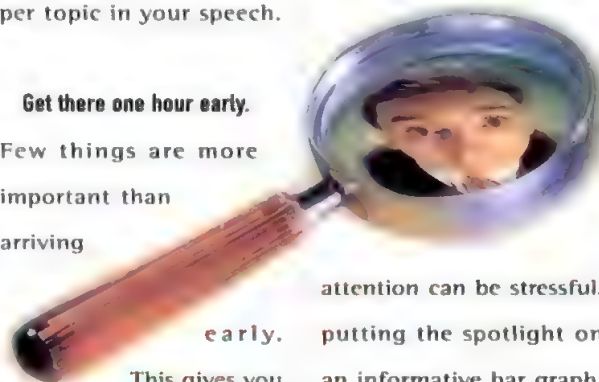
Few things are more important than arriving

early. This gives you the chance to rehearse in the same environment in

which you will actually be giving your presentation. It also means that you'll be able to practice with the equipment you will be using, and to make sure that everything is set up and in working order.

Use presentation aids.

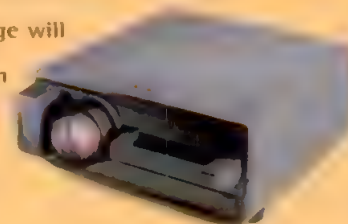
Visual aids are more than a way to help get points across. They can also help control your nervousness. Since being the center of



attention can be stressful, putting the spotlight on an informative bar graph, chart or model will often alleviate the pressure.

Feeling at ease with your LCD projector. One thing you should never have to worry about is how your video equipment will perform. Which is where our VPL-V500Q portable LCD projector comes in. It offers the bright, uniform images you need for a professional presentation. With no annoying hot spots or darkened corners. Everywhere you look, your image will be both bright and true. To learn even more, turn the page.

SONY



A brief presentation on our LCD projectors.



Including the VPL-V500Q, there are three LCD projectors in our LCD family.
Call us at the number below to determine which is best for you.

Optional Accessories



PSS-500 Ceiling Mount

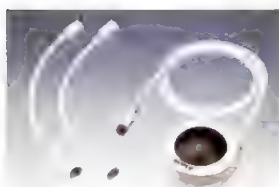


VLC-500 Soft Case

Standard Accessories



RM-PJM500
Wireless Remote Commander® Unit



RM-PJ20
Wireless Mouse Receiver

With the advantages listed here, our VPL-V500Q LCD projector can turn any meeting room, training room or classroom into a multimedia presentation forum.

1. A Brilliant Image. Light output of 500 ANSI lumens (VPL-V500Q model only) offers spectacular brightness.

Even on large screens in rooms with ambient light.

2. A Consistent Image. Our newly developed optical unit and 250W DC drive metal halide lamp combine to provide uniform brightness and color from corner to corner.

3. A Portable Image. Since the VPL-V500Q is compact and light, it travels easily for out-of-town presentations.

4. An Image That's Easy to Project. Just hook up a compatible signal source with the supplied cable (and adapter for Macintosh® computers). From there, the joystick-type Remote Commander® unit and on-screen display menus make any final setup and adjustments quick and simple.

5. An Image We Stand Behind. All our LCD projectors have a 3-year/3-year warranty on parts and labor, as well as a 90-day lamp warranty. (See actual warranty for details.)

Our wireless Remote Commander unit and wireless mouse receiver are standard (VPL-V500Q). Soft case, hard case, ceiling mount and replacement lamp are optional.

To learn more, or to purchase a VPL-V500Q from any of our select Sony resellers, call 1-800-472-7669, ext. LCD.



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VPL-V500Q Specifications

Projection system:

3 LCD panels, 1 lens,
projection 1.3-inch
p-Si TFT LCD panel,

921,600 pixels

(307,200 pixels x 3 panels)

Projection lens:

1.6 times zoom lens f50
to 80 mm/F2.5 to 3.1

Lamp:

250W metal halide lamp

Screen coverage:

40 to 300 inch

Light output:

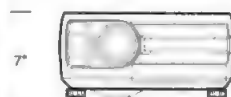
ANSI: 500lm

Weight:

22 lbs.

Dimensions:

VPL-V500Q



14 1/2"



16 3/8"

mm = 368(W) x 176(H) x 420(D)

inches = 14 1/2(W) x 7(H) x 16 3/8(D)

SONY

Image Editing

an impressive Warp function that applies a 3-D-like mesh to an area that has already been defined by a mask. When this special mesh has been applied, the user can move around the control points of the mesh to fold the area onto itself, using lighting, shadows, and even phong shading. Unfortunately, this advanced use of light and shadows does not carry over into any other tool for creating lighting effects.

Considering that it's the product of a one-person company with limited resources, QFX does a remarkable job of photo editing. But its many points of brilliance come to an abrupt halt and ultimately confine the program to a back seat behind its more full-featured competition.

QFX. List price: \$795. Requires: 386-based PC or better, 8MB (for Windows 95) or 32MB (for Windows NT) RAM, 1MB hard disk space, Microsoft Windows 3.1 or later or Windows NT 3.51 or later. Ron Scott Inc., Houston; 713-529-5868; fax, 713-529-9370; www.qfx.com. *Circle 449 on reader service card.*

Macromedia Inc.

Macromedia xRes 3

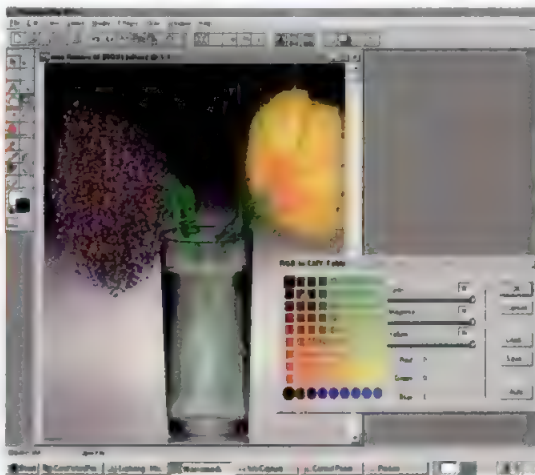
A pastiche of image-editing styles, Macromedia xRes 3 (\$400 street) doesn't seem to have a personality of its own that would make it stand out from the rest of the crowd. Its dual-mode structure resembles QFX. Superficially, its creative brushes look like Painter's, and Photoshop users will recognize familiar tonal controls and compositing tools.

Despite this lack of a unique identity, xRes still manages to perform well. Its on-demand editing mode uses tiled multi-resolution bitmaps in a proprietary LRG file format, so you can view or process screen-resolution pixels only (at various set magnifications). Batch and individual conversions of images to LRG are quite fast, while rendering finished images to other file formats takes only a little longer than typical saves. Unfortunately, we experienced unexpectedly lengthy delays when we opened LRG

images that contained as few as 15 objects (with their masks).

STYLING EASE

Working in xRes mode is quick and easy, which is the case with any on-



In Macromedia xRes's preferences, you can edit the color tables for converting RGB to CMY and vice versa.

demand pixel editor. Toggling to direct mode provides tools within the very same interface, but it works on and updates all of the image's pixels. When you toggle from direct mode to xRes, the image (and its objects) are automatically converted to LRG format. Unfortunately, you're required to save every image object to the hard disk before you can continue editing. On the other hand, you can drag and drop objects between pictures, even if one is in xRes and the other is in direct mode.

The program uses objects rather than layers, although the palette organization and features are quite similar to Photoshop's layers palette. This includes drag-and-drop ordering, blend modes, and an opacity/transparency slider. Unlike Painter, xRes allows you to create empty objects whose default size is that of the image, and you can also set them up to be smaller. But when we made a large empty object to paint one of our flowers, we were unable to then crop the object to the size of our painting.

Channel and path palettes, nested with the objects palette, provide similarly familiar functionality. Each image object can have up to 32 alpha channels—many more masks per object than other

object-editing pixel programs we tested. Because it offers customizable brushes, xRes inevitably faces comparison with Painter. Even though xRes's brushes have a good variety of options (such as texture, tips, and flow), the program has neither the depth nor the user control of Painter. In fact, when you set any brush to artistic mode, you will not be able to find a transparency slider (this is available only in the fast mode).

SHINING MOMENTS

Xres's multicolor gradients are easy to define; an associated mask for color transparencies is actually a user-definable, multilevel gray-scale gradient. Similarly, the dynamic range and brightness/contrast tools are comprehensive, deep, and easy to use. And xRes displays previews quickly and directly on the full image, rather than on a dialog thumbnail.

Internet production tools include a Shockwave component for viewing high-resolution images over the Internet. Color-indexing images from 24- or 32-bit to 8-bit is flexible. In addition to adaptive and uniform colors, you can create an indexed palette from an 8-bit image to use as the reference index for other pictures. We had no difficulty indexing a series of pictures to the Netscape palette. You can define any object as a URL hot spot, and xRes saves a server-side NSCA map with the JPEG or transparent .GIF file.

Although xRes isn't likely to replace Photoshop or Painter in professional graphics, and despite the fact that it doesn't have the depth of features of Photo-Paint, it is nonetheless a strong contender. Its familiar interface allows users to focus on productivity and creativity rather than on technology. And despite some limitations, the sum of its parts represents a good value in both power and features. □

Macromedia xRes 3. Street price: \$400. Requires: Pentium-based PC or better, 16MB RAM, 14MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Macromedia Inc., San Francisco; 800-326-2128, 415-252-2000; fax, 415-626-0554; www.macromedia.com. *Circle 445 on reader service card.*

EIZO NANAO WINS AGAIN!

Back To Back Nod For Monitor Maker

By Rex O. Loonham
MONITOR STAFF WRITER

LOS ANGELES — It's an announcement that is becoming all too familiar. EIZO Nanao Technologies has once again taken home the coveted Editor's Choice Award from PC Magazine.

This sixth award in the past six years goes to the company's FlexScan® TX-C7S 17-inch class color monitor. It's an honor that carries particular significance as it cites superiority in the judging category having the toughest standards.

"The TX-C7S monitor's image was especially sharp and clear, with no detachable faults," said a PC Magazine judge.

Not too surprising for EIZO, though. The company's monitors previously earned Editor's Choice



**October 8, 1996
FlexScan TX-C7S**

accolades in 1990, 1992, 1993— for its FlexScan 9400, F550iW and FlexScan F340iW monitors—and last year for its highly regarded FlexScan T2-17TS model.

TX-C7S Lauded as 'Best of the Best'

By E.Z. Viewin
MONITOR STAFF WRITER

LOS ANGELES—Words such as "unbeatable," and "top flight," have been flying around town ever since EIZO Nanao's FlexScan TX-C7S 17-inch class color monitor walked off with the 1996 PC Magazine Editor's Choice Award.

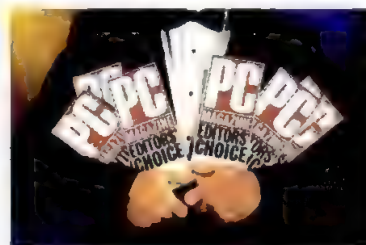
With this key award under its belt, the FlexScan TX-C7S figures to be the monitor of choice for graphics and business professionals who demand crisp, true-to-life colors and stable screen images



This year's big winner: The FlexScan TX-C7S 17-inch class color monitor.

for desktop publishing, 24-bit imagery, high-end graphics and multimedia applications.

Editor's Choice: The Award That Shapes Industry Thinking



It's déjà vu all over again: EIZO Nanao has now won six Editor's Choice Awards in six years.

By Mona Turr
MONITOR STAFF WRITER

LOS ANGELES—Winning a PC Magazine Editor's Choice Award tells the world of hungry hardware buyers that you've arrived in a big way.

"It's the one award we all dream about, the one we covet more than any other," said N.V.S. Guy of Silicon Valley's LuzerCom.

EIZO Nanao monitors have earned worldwide recognition for dependability, cost-effective performance and pleasing, ergonomic design. In fact, I'm going to stop writing this story right now so I can call EIZO Nanao Technologies at **1-800-800-5202**. Then again, I could get an informational fax on demand by calling **1-800-416-FLEX**. Either way, like the TX-C7S, I'm a winner.



EIZO is Nanao's New Universal Brand Name
EIZO Nanao Technologies Inc., 5710 Warland Dr., Cypress, CA
90630 Web Site: <http://www.eizo.co.jp/welcome>

THE PC

Illustration

New illustration packages give you easier, more responsive, and more powerful tools for creating vector graphics, both for print and for the Web.

When you need to create a corporate asset that will look as good on the Web as on a billboard, you need an illustration program that handles vector graphics. Scalability is the key to the value and power of vectors.

Vector graphics or illustration programs have always used an object-oriented approach to computer graphics, allowing you to draw outlines that define objects, then to fill them with a paint or a pattern. You can perfectly render these outlines at any size because they are formed by a mathematical model of points and curves, not by a grid of filled-in square pixels the way bitmaps are created.

New features we found in this category include multi-colored graduated fills. Primitives such as polygons, stars, and spirals have become commonplace. Linked colors allow you to change a rose from red to yellow by changing only the base color; all the linked tints change

automatically. Layered interactive graduated transparencies add depth never before available, and you can convert vectors to bitmaps within the vector graphics file. Whereas yesteryear's vector programs allowed you to place a bitmap in your file, today's are capable of embedding, sizing, and even applying special effects and masks to bitmapped images. This makes it easy to produce final output by layering graphics—merging vectors and bitmaps as necessary to produce logos, printed advertisements, and images for the Web.

Of all the new features, the most exciting are the proprietary Web plug-ins that bring vector graphics and navigation to the Web. Vector graphics file sizes can be tiny compared with similar bitmapped graphics, and you can typically zoom them to 25,000 percent. You can now attach URLs to any object.

The newest packages sport paradigms that are changing the face of vector graphics. CorelXara 1.5 offers qualita-

By Linda & Erick Von Schweber

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Illustration

tively superior rendering, astounding .GIF and JPEG output, and a phenomenally fast vector graphics browser plug-in. Fractal Design's Expression 1.0 lets us stroke outlines with other complex vector graphics, producing infinitely varied visual features unmatched by other programs.

Overall, we were delighted with the strengths of these packages. Consider upgrading your current program, as well as adding one of the newer specialty packages to your toolbox.

Adobe Systems Inc.

Adobe Illustrator 4.1

ALL REVIEWS BY LINDA AND ERICK VON SCHWEBER

Adobe Systems has finally released a successor to its 1992 Adobe Illustrator 4.0, but Version 4.1's \$495 list price is one of the highest of any stand-alone vector graphics program in this roundup—and without good reason.

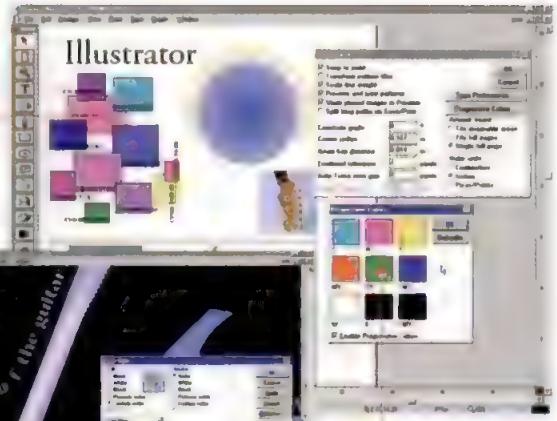
Adobe Illustrator 4.1 runs in Windows 95 but uses Windows 3.1-style dialog boxes and short filenames. Illustrator's functionality is currently so far behind that of CorelDraw 7—not to mention its sibling, Macromedia FreeHand 7—that we can't recommend it as a program for graphics professionals until Adobe releases a significant upgrade. At press time, the company was working on a 32-

Adobe Illustrator's CMYK handling and color printing remain strong points, but FreeHand offers the same features and more.

bit implementation but still hadn't announced a time frame for its release.

A THING OF THE PAST

The grandfather of vector graphics, Illustrator was once state-of-the-art, having created the model on which all the other programs in this roundup were based. But every other product has since moved on. Macromedia FreeHand, for example, does a better job of importing EPS and .AI files than Illustrator does, while maintaining the CMYK color accuracy for which Illustrator was known. CorelDraw long ago upped the ante with gradient fills, true layers, Boolean operations, and special effects. Canvas 5 provides pixel-level bitmap editing and a drawing area of almost 1,500 square feet;



Although Illustrator uses Windows 3.1-style dialog boxes, the program still manages to provide most of the color options you need.

Illustrator's default kerning of text on a path left odd spaces between the letters—and there's no way to adjust kerning manually.

Illustrator's is a mere 2.25 square feet. Micrografx Designer offers superior drawing tools, integration with Windows 95 and Microsoft Office, and technical illustration savvy, while CorelXara introduces true transparency for vector objects and embedded bitmaps. Fractal Design Expression, in turn, has enabled extraordinary effects and variations with its Skeletal Strokes.

Unfortunately, Illustrator's comparatively limited feature set doesn't mean it's easier to use. We calculated that a rainbow gradient fill that takes 5 mouse clicks

SUITABILITY TO TASK: ILLUSTRATION SOFTWARE

N/A: Not applicable—The product does not have this feature.

POWER

	Adobe Illustrator 4.1	Canvas 5	CorelDraw 7	CorelXara 1.5	Fractal Design Expression	Macromedia FreeHand 7	Micrografx Designer 7
Artistic illustration	Fair	Fair	Excellent	Excellent	Good	Good	Good
Technical illustration	N/A	Excellent	Good	N/A	N/A	N/A	Excellent
Color printing	Excellent	Good	Good	Good	Fair	Excellent	Good
Web publishing	N/A	N/A	Good	Excellent	Fair	Excellent	Good

EASE OF USE

	Adobe Illustrator 4.1	Canvas 5	CorelDraw 7	CorelXara 1.5	Fractal Design Expression	Macromedia FreeHand 7	Micrografx Designer 7
Artistic illustration	Poor	Fair	Excellent	Excellent	Excellent	Good	Good
Technical illustration	N/A	Good	Good	N/A	N/A	N/A	Excellent
Color printing	Good	Good	Poor	Good	Poor	Excellent	Good
Web publishing	N/A	N/A	Good	Excellent	Poor	Excellent	Good

Artistic illustration involves the fluidity of a program's drawing tools. Products must also be able to import and export a variety of file types accurately.

Technical illustration ratings describe how precisely a package's toolset helps you create and place objects via numeric entry, array generation, and constraints.

Color printing refers to the software's color-matching capabilities and output quality. Illustration programs should be able to specify traps, make spot-to-process color conversions, and create color separations accurately.

Under **Web publishing** we consider how well the program creates content for the Web. We also evaluate the quality of the plug-ins for viewing and manipulating vector graphics in a browser.

Most of our testing was performed on Micron Millennia Pentium/133 PCs with 64MB of RAM, 2GB hard disks, Matrox Graphics' MGA Millennium graphics adapters with 4MB of memory, EIZO Nanao Technologies' FlexScan T2-20 20-inch monitors, and Wacom Technology's ArtZ11 6- by 8-inch graphics tablets.

Editors' Choice

• Macromedia FreeHand 7



Each of the seven illustration programs we tested has unique strengths and weaknesses. One of them, however,

stood out, delivering exceptional value with minimal problems.

Macromedia FreeHand 7 wins our Editors' Choice because it consistently produced perfectly matched output for four-color CMYK printing, RGB printing (for ink jet and color laser printers), and digital file formats, including those for high-resolution bitmap editing and for the Web. As tools go, FreeHand was neither the slickest nor the most fun to work with, but it was the most reliable and the most consistent vector graphics program we tested.

When we created an image in FreeHand, we could trust that the image could be published in any and all supported formats. In addition, we were so impressed with FreeHand's ability to import Adobe Illustrator files that we recommend users of Illustrator move their files and designers to FreeHand.

We were also impressed with FreeHand's handling of paragraph text. You can control how text wraps around or inside an object, as well fine-tune kerning and text spacing.



in CorelDraw requires 67 mouse clicks in Illustrator, because you must create blends between each pair of major colors. Creating gradient-filled text on a path was such a chore that we decided to modify our test script for Illustrator.

BASIC TOOLS

We found Illustrator's drawing tools adequate for drawing our guitar outline (see the screenshot), but it has no gradient fills, extrusion, or blends among grouped or complex objects. We finally created a blend to provide gradient fills for two guitars and used another blend to produce the plain guitars between them. Illustrator seemed to load our LOGO.EPS file, but when we saved the file with the logo, we couldn't open the file again in Illustrator. We were able to load the file into FreeHand, remove the offending EPS file, save it as an .AI file, and open it again in Illustrator. Our embedded color TIFF file's preview colors were very distorted, and Illustrator offered no support for color correction, filters, or resampling the bitmap—much less special effects.

Adobe Separator, a module that comes with Illustrator (along with Adobe Streamline, Adobe Type Manager, and Adobe Type on Call), does perform CMYK separations.

Placing text along a path was straightforward, but Illustrator insisted on adding spaces between letters to prevent characters from overlapping. We couldn't, however, remove the spaces—which were much too large—unless we adjusted the spacing with Illustrator's Kerning Control. Illustrator imported an RTF file, listing the proper font name at the top of the paragraph but resetting the font to Helvetica. In addition, Illustrator can't export .GIF or JPEG files for use on the Web. And though color printing remains bulletproof in Illustrator, we were just as impressed with FreeHand's handling of CMYK colors (and FreeHand has the same version on both Windows and Macs). Also, beware of Illustrator's problems dealing with graphics cards based on the S3 chip (Adobe cautions users about this problem).

Although Illustrator blazed the trail for other drawing packages, it has fallen

Macromedia's plug-in architecture allows you to use Macromedia or third-party Xtras to enhance FreeHand functionality. The Afterburner plug-in, for example, compressed graphics for the Web between 30 and 75 percent on our tests. We were, however, disappointed by Macromedia's Shockwave plug-in for the Web. On our tests, it tended to be very slow and did not always render the image properly.

Unfortunately, FreeHand lacks some of the bells and whistles provided by CorelDraw 7 or even Micrografx Designer 7 and therefore requires more artistic talent to produce great graphics. But its perfect output means that even newcomers will generally be more successful printing from FreeHand.

A relatively new program, CorelXara 1.5, deserves honorable mention. Although it is positioned as an add-on to CorelDraw 7, CorelXara is actually much more. The program delivers an experience that is qualitatively different from that of any other illustration package we tested. The interface provided everything we needed and never got in the way. The performance was always so fast, we never noticed that the program was working. CorelXara generated the best .GIF and JPEG files. The on-screen anti-aliasing and the exported .GIF file dithering were visually exquisite.

But it's CorelXara's Web plug-in that earned it an honorable mention and changed our minds about the viability of vector graphics on the Web. The plug-in produced proprietary .WEB format files significantly smaller than comparable .GIF and JPEG files. With 25,000 percent zoom, you could hide a ladybug on a blade of grass in a forest scene and attach a URL to it. While it remains to be seen if this format is accepted on a mass scale, the value to those sharing technical illustrations or detailed drawings is immediate.

behind the pack. Until Adobe overhauls it, we recommend you look elsewhere. If you're still working in Illustrator and have legacy Illustrator files, seriously consider FreeHand as an alternative.

Adobe Illustrator 4.1. List price: \$495. Requires: 386-based PC or better, 8MB RAM, 9MB hard disk space, Microsoft Windows 3.1 or later. Adobe Systems Inc., San Jose, CA; 800-843-7263, 408-536-6000; fax, 408-537-6000; www.adobe.com. Circle 441 on reader service card.

Deneba Systems Inc.

Canvas 5

By attempting to deliver integrated drawing, bitmap creation and editing, and page layout all in one program, Deneba Systems' Canvas 5 emerges as a jack of all trades and master of none.

At \$599.95 list, Canvas offers neither the value nor the range of features necessary to pull off this perhaps overly ambitious goal. Although Canvas claims to provide a number of capabilities in one package, we found that you really have to

Illustration

choose which type of document you plan to create right from the start.

Depending on the type you select—Presentation, Publication, or Illustration—you have different capabilities and limitations, and Canvas can't move files seamlessly between these formats. An Illustration Document can have only one page, but it can have multiple layers (though Deneba claims you need only one page for an illustration). A Publication Document can have multiple pages but only one layer. And if you place a Publication Document into an Illustration Document, you get only the first page.

THE GOOD, THE BAD

We chose to work with Canvas using the Illustration Document mode because we needed the control over layers and were able to work with one large page for building our test spread. Canvas was the only program unable to import the test LOGO.EPS file; it brought in an Adobe Illustrator file with separate objects for the outline and the fill.

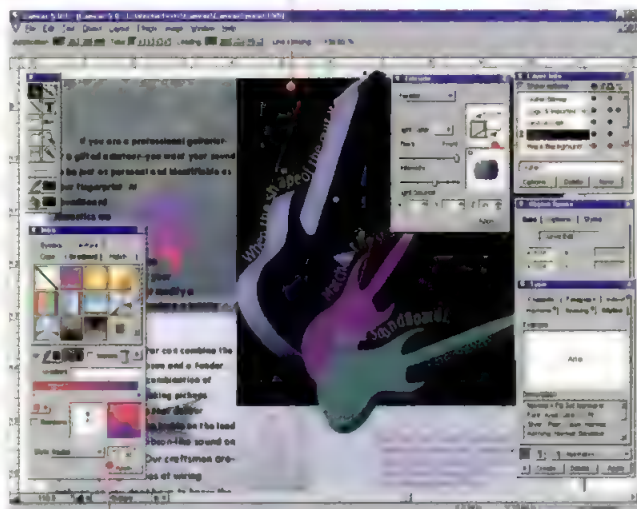
On the other hand, drawing our guitar was easy. Canvas's Bezier curve tools allowed us to shape the guitar as we went, clicking and dragging to create curves. Once we had the shape, a single click let us size the object; a double click put us into rotate and skew modes; and a triple click put us into point edit mode, where the right mouse button brought up a context-sensitive menu.

When we last reviewed illustration graphics programs, it seemed that performance was a problem with every program. This time, only Canvas made us wait. A close-up of our gradient-filled circle surrounded by gradient-filled text could take 15 or more seconds to write to the screen and was not interruptible. Bugs were another problem, occasionally resulting in crashes but more often generating an incorrect screen display. For instance, when we set the display to wireframe mode, we could see our text on a path, but our guitars totally disappeared.

TECHNICALLY SPEAKING

We've always liked Canvas's technical illustration tools, and this time was no exception. We set our document dimensions

Canvas 5's sophisticated Bezier tools allow you to draw complex shapes such as this guitar by clicking and dragging along a path.



Fills are managed from an Inks palette in which you can name and save colors, gradients, textures, and more.

to "1 inch = 1/4 inch" in the rulers dialog box. Creating our guitar pick-up was a breeze with array copy, extrusion tools,

and the Smart Mouse. Dimension line options are extensive, and when you group them with objects, they scale properly.

The first—and still the only—illustration package to provide pixel-level editing for bitmaps, Canvas has added more robust bitmap creation and editing tools. Though these tools were a good idea several years ago, they cannot compare with those offered today in Corel Photo-Paint, Macromedia xRes, and Micrografx's Picture Publisher, all of which support OLE and are part of larger graphics suites that include drawing programs. Canvas now includes image filters and channel-adjustment tools, but it doesn't offer PhotoShop plug-ins (although it supports some) like FreeHand or special effects like CorelDraw.

Although Canvas doesn't have a plug-in for Web browsers, it can export both .GIF and .JPEG files. On our tests, however, Canvas dropped out one of two text boxes, and bitmapped files came out dithered—even when we specified no dithering. For graphics-intensive work, as well as print and Web output (Deneba contends it will offer free downloadable plug-ins from its Web site by the time you read this), we sug-

gest looking at the other products in this story. But if your main function is to produce technical illustrations, you may find Canvas to be a valuable program that provides additional features to dress up your presentations of those illustrations.

The Extrusions tool lets you set light, colors, location, and intensity. Canvas lets you edit extrusions after they've been created.

Canvas 5. List price: \$599.95. Requires: 486-based PC or better, 8MB RAM (16MB for Windows NT), 35MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Deneba Systems Inc., Miami; 800-622-6827, 305-596-5644; fax, 305-273-9069; www.deneba.com. Circle 442 on reader service card.

Corel Corp.

CorelDraw 7

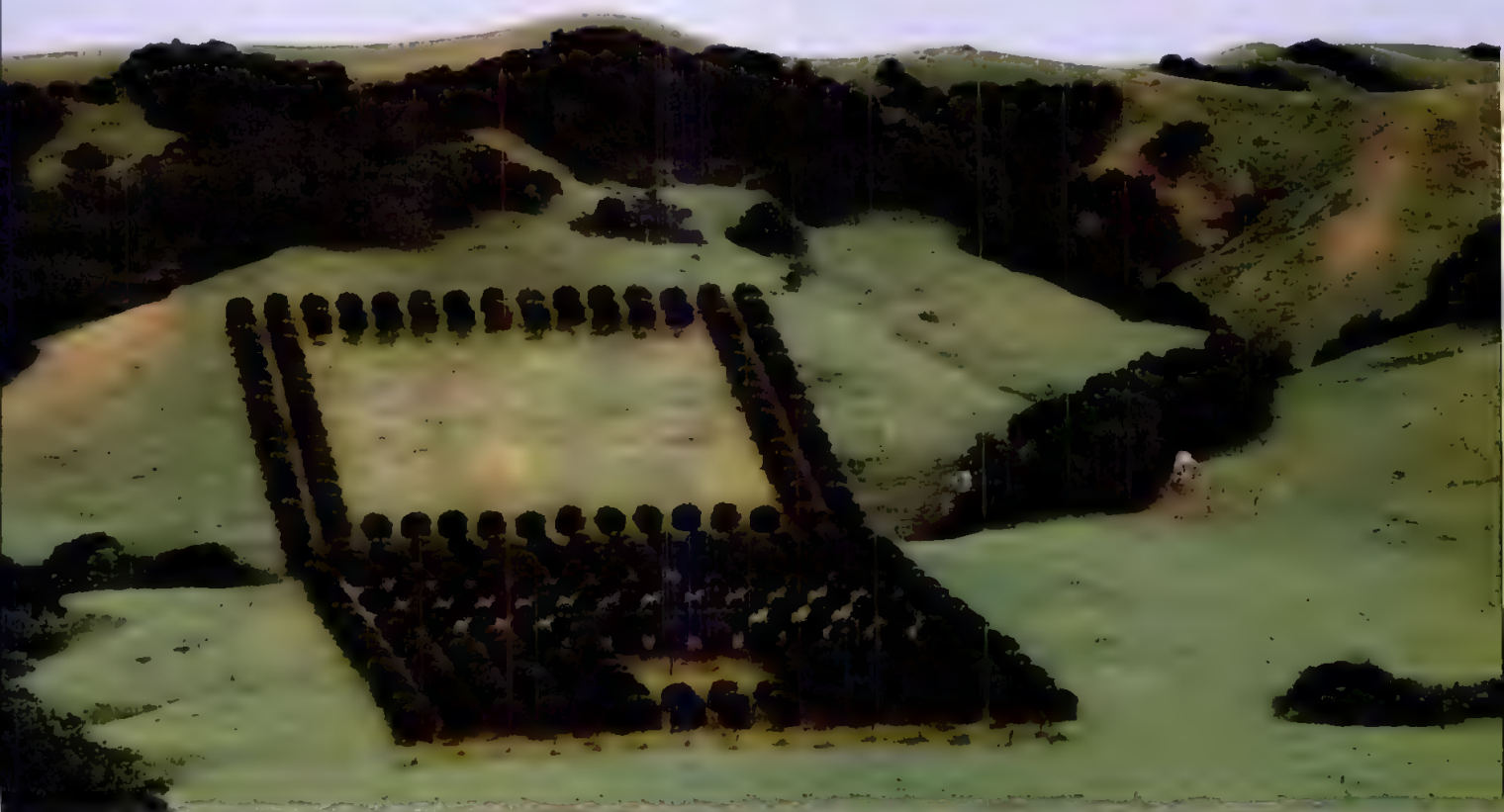
When we first examined CorelDraw 7 (First Looks, February 18, 1997), we were impressed. Corel packs a lot into this suite (\$695 list), including Corel Photo-Paint. It has the most extensive toolset—hands down—of any program in this roundup, its interface has been simplified, and its drawing and node-editing tools are more responsive than ever. But it falls short of CorelXara 1.5 in terms of Web publishing and other new features.

CorelDraw's handling of CMYK colors is less impressive. Colors to the .GIF and .JPEG files were significantly different from the final output to the Matchprint proof. By contrast, FreeHand flawlessly displayed identical colors to the screen, to Web files, and to both printers.

EASY DOES IT

With the beveled extrusion tool, we easily produced the 3-D guitars from a 2-D outline. We assigned interactive two-point gradient transparencies to bitmaps and simple vector objects, each point defining a percentage of transparency. While this technology was drawn from Corel Xara 1.0, CorelDraw could not

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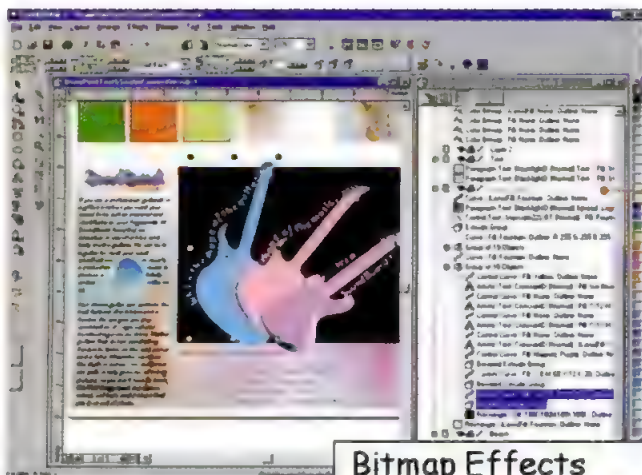
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compatibility with older versions of CorelDraw, Kodak's color correction must be turned on through

CorelDraw's Object Manager lets you track, edit, and reorganize objects easily.

the View menu every time you open CorelDraw. Second, if your printers are not on the limited list of support-

screen. Barista, Corel's Java-based format for displaying documents on the Web, is a promising technology but is currently best used for simple documents.

Though we were impressed with CorelDraw's massive toolset, the devil's in the details. The massive toolset makes Corel-

Draw 7 great for drawing, but its unreliable output both to print and the Web make it limited. If you want all the bells and whistles CorelDraw offers, we recommend waiting for its next revision, checking Corel's Web site regularly for any new patches, and starting with a call to tech support to be sure your color correction is set up properly.

CorelDraw 7. List price: \$695. Requires: Pentium/60-based PC or better, 16MB of RAM, 40MB hard disk space, and Microsoft Windows 95 and Windows NT 4.0. Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-3733; fax, 613-761-9176; www.corel.com. *Circle 443 on reader service card.*

Corel Corp.

CorelXara 1.5

Using CorelXara is like driving a sleek red Ferrari convertible in the springtime through a beautiful park. With an interface so clean and simple, CorelXara will make you wonder why people thought illustration software was so hard to master in the first place.

CorelXara (\$289 list) is one of the new breed of programs we tested for this story. It focuses on graphics one page at a time, and on text one block at a time. It lets you do things with drawings, gradients, images, and transparency that you'd only dreamed of. Though Corel has positioned CorelXara 1.5 as an add-on to CorelDraw 7 for creating Web graphics, CorelXara actually outperforms CorelDraw in many respects with its speedy operation, Web support, and specialized tools.

With the scalability of vector graphics and the texture of bitmaps, 2-D is becoming more like 3-D. Draw an object. Apply a texture (bitmap) or paint (material) to it. Define a level of transparency. Then move it and edit it to your heart's content. We built the guitar with CorelXara's Bezier drawing tool. We clicked and

support more than two different percentages of transparency per object or group; CorelXara 1.5 supports twice as many percentages.

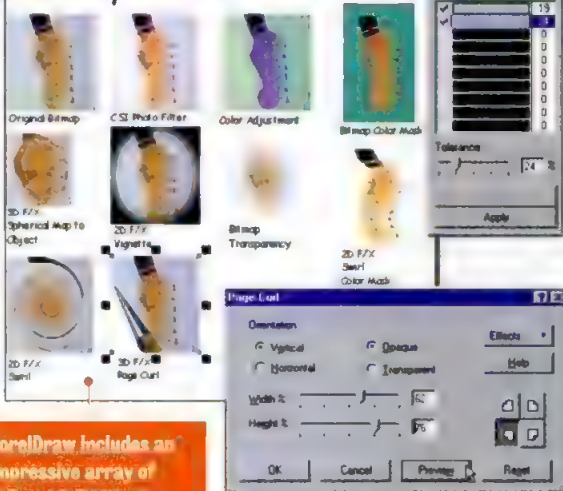
CorelDraw's artistic text-handling was flawless, and its default kerning of letters on a curve didn't require any editing to keep the letters from overlapping, as they did in Canvas and FreeHand. The lens features are incomparable, providing many special effects, including the ability to magnify only a portion of the image and to automatically adjust the colors of text based on the background colors.

We cropped images, applied color filters, and added a page curl to bitmaps using the new 2-D and 3-D effects and PhotoShop plug-ins. When we wanted to edit pixels, CorelDraw automatically took us to Corel Photo-Paint (reviewed in the Image Editing section), where we could edit the file and save it right back into CorelDraw. Other than offering basic scale settings and dynamic dimensioning tools, however, CorelDraw doesn't have any special technical drawing capabilities—such as the Smart Mouse in Canvas or the array copy in Designer.

NOT SO SEAMLESS

CMYK output, CorelDraw 7's nemesis, is still perilous—even though the program now supports Kodak's CMS (color management system). First, to maintain

Bitmap Effects



CorelDraw includes an impressive array of 2-D and 3-D bitmap effects, as well as Photoshop-compatible plug-ins.

ed peripherals, CorelDraw doesn't always guarantee that an appropriate generic driver will be available. We were simply

not able to get color-corrected output to our HP DeskJet 310C printer because there wasn't a device driver for it, and there wasn't a generic RGB printer driver we could use instead. This meant that on our screen, blue printed as cyan, coral as hot pink, and plum as purple.

While planning to reuse the artwork for a Web site, we discovered another bug. CorelDraw exports the colors as displayed with color correction turned off, so our .GIF and JPEG bitmaps had the same incorrect colors that were output on our HP printer. To get good Web output, we found it best to select super sampling when we exported bitmap files. The Corel .CMX viewer was painfully slow, and .CMX files are larger than .CDR files—not the sort of thing to put up on the Web. Corel Barista output of the guitar spread simply could not write to the

SUMMARY OF FEATURES

Illustration Software



■ YES ■ NO

Products listed in alphabetical order

	Adobe Illustrator 4.1	Canvas 5	CorelDraw 7	CorelXara 1.5	Fractal Design Expression 1.0	Macromedia FreeHand 7	Micrografx Designer 7
List price/Street price	\$495, \$390	\$599.95, \$400	\$695, \$480	\$289, \$200	\$449, \$300	N/A, \$400	\$349.95, \$330 (as part of Graphics Suite 2)
Macro recorder/OLE server/OLE client	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Color-mixing models	CMYK	CMYK, HSL, RGB	CIE Lab, CMY, CMYK, HSB, HSL, RGB, YIQ	CMYK, HSV, RGB	CMYK, HSL, RGB	CMYK, HSL, RGB	CMYK, HSL, RGB
Illustration Management							
Lock/hide objects	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Lock/hide layers	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Master pages/Templates	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Move objects between layers/Object manager	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Object properties/Object data	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Object styles/Text styles/Linked colors	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Illustration Tools							
Beveled, rounded, and mitered corner joins	■	■	■	■	■	■	■
Bitmap/fractal/vector fills	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Gradient/transparent*/PostScript fills	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Calligraphic/parallel/dimension lines	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Intelligent connecting lines	■	■	■	■	■	■	■
Gradient/natural-media strokes	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Object- and Bitmap-Manipulation Tools							
Align/distribute objects	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Snap objects to guidelines/grid	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Snap objects to objects/nodes	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Combine/break/slice objects	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Blend/envelope objects	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Boolean/weld objects	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Bevel/Extrude/Perspective	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Clip bitmap to object/Clip (mask) object to object	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Edit/manipulate bitmapped images	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Mask bitmapped color channels/Trace color bitmaps	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Apply 2-D effects/3-D effects/PhotoShop plug-ins to bitmaps	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Text Handling							
Tracking/kerning/leading	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Flow text between frames/inside objects	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Fit text to path/Wrap text around objects	■ ■	■ ■ (one side)	■ ■	■ ■	■ ■	■ ■	■ ■
Set columns/bullets	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Graphics Handling							
Export selected objects/export size/resolution	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Imports .AI/.EPS/.WMF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Imports .CDR/.DXF/.PDF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Imports .PCX/Photo CD/Pict (Macintosh)	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Imports .JPG/.TGA/.TIFF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Exports .AI/.EPS/.WMF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Exports .CDR/.DXF/.PDF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Exports .PCX/Pict (Macintosh)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Exports .JPG/.TGA/.TIFF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Web Support							
Imports standard .GIF/transparent .GIF/animated .GIF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Exports standard .GIF/transparent .GIF/animated .GIF	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Exports image maps with embedded URLs	■	■	■	■	■	■	■
Browser plug-in for vector format with URLs attached to objects	■	■	■	■	■	■	■
Print Options							
Print selected objects/layers/pages	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■ N/A	■ ■ ■	■ ■ ■
Major color-matching models	Focoltone, Pantone, Toyo, Trumatch	Pantone, Toyo, Trumatch	Focoltone, Pantone, Toyo, Trumatch	Focoltone, Pantone	None	Focoltone, Pantone, Toyo, Trumatch	Pantone
Color separation	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature. * Transparent fills refers to true, live, interactive transparencies.

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dragged to create a curve and used icons to switch from point-edit mode to object-level mode. It was just as easy to reshape, remove, and join bits together.

MAKING IT LOOK EASY

CorelXara's interface is elegant and simple. Icons on the top row access full-color visual galleries of colors, fills, strokes, bitmaps, fonts, and clip art. When we selected the interactive Transparency Tool from the Selector Toolbar on the left, the Infobar on the top presented us with all the controls we needed. For our guitars, we chose a four-point transparency and set each corner to a different percentage. This transparency was applied to a blended group of two complex guitars, each containing three objects, two gradients, and a bitmap—all on top of a purple rectangle feathered to transparent lavender intersecting the feathered transparent corner of a bitmap image of a girl on a beach. A drawing this complex sounds nearly impossible to execute, but with CorelXara it was easy.

CorelXara helps you manage colors by creating families of linked shades. Change the base shade from blue to green, and your entire object follows suit. Note that CorelXara has no special tools for technical illustration and that you must input text yourself, since CorelXara provides no import filters for word processing programs. Yet it was the only product we've seen that lets you flow multiple lines of text on a single curve, and its font gallery shows the fonts, not just their names. It did a very good job of tracing our color bitmap of a guitar handle, intelligently allowing you to set noise parameters so that it doesn't try to create a new object for every color variant the way CorelDraw does.

WONDERS FOR THE WEB

The most powerful new tool to come along for Web graphics, CorelXara's plug-in for Netscape Navigator and Microsoft Internet Explorer 3.0 allows you to magnify the image, from inside your browser, up to 25,000 percent. Macromedia FreeHand's Shockwave for

Graphics can do the same thing, but CorelXara rendered to the screen instantly, even on our test-bed 133-MHz Pentium PC. You can assign objects as Web addresses, and they'll act as links from within the plug-in. Without its bitmap images, the sound-board advertising spread was 71K, compared with 45K as a JPEG file and 154K as a .GIF file. This file size and performance make vector graphics an exciting new prospect for Web design.

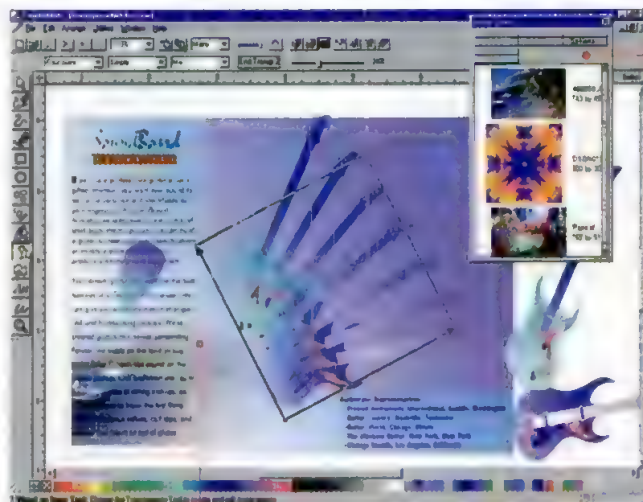
CorelXara ships with a Web template and color palettes, and it's the only

Fractal Design Corp.

Fractal Design Expression

With its revolutionary approach to vector graphics, Fractal Design Expression delighted us. The program brings natural media strokes and more to vector graphics, creating new possibilities. But since Expression (\$449 list) is not a full-featured package, it may be best used as a complement to other graphics packages with its excellent bitmap output.

While programs such as CorelXara and Designer have added the ability to fill



CorelXara 1.5 impressed us with its blending of complex objects and phenomena, and feathered interactive transparency.

Toolbar icons let you gain quick access to galleries of colors, fills, strokes, bitmaps, fonts, and clip art.

a line with a gradient, Expression takes us into new territory with its ability to treat a line or outline as a path on which you can apply another image. In Expression's terms, the core concept is a Skeletal Stroke consisting of a line as a skeleton and any graphic image as a stroke. Think of the vein of a leaf as its line/skeleton and

the leaf shape and coloring as the graphic image/stroke. Drawing leaves becomes a simple matter of drawing lines.

SKELETONS IN THE CLOSET

For our test, we first used Expression's well-implemented drawing tools to recreate our guitar. We gave the guitar's outline a rainbow gradient fill and its interior a golden gradient fill. We used the stroke definition tool to convert the guitar to a Graphic Element Skeletal Stroke. Selecting it from the visual Stroke Warehouse and drawing a line created a "skeleton" for the guitar. Curving the line curved the guitar. Drawing a rectangle stretched the guitar into an outline of a rectangle.

By creating anchors for the base and top of the guitar, we were able to stretch it without distorting its identifying features. Using another technique, we made the guitar into a repeating element, so when we created a circle with it we had three guitars perfectly curving around the outline. We also created several "key" frames by moving points until the guitar resem-

drawing package able to produce animated .GIF files directly. We created an animation by repeatedly modifying a drawing, using Arrange, Create Bitmap Copy, then sequencing the bitmaps in the bitmap gallery. Animated .GIFs do not require a plug-in and will automatically play in a browser.

CorelXara won't do everything, but it has some compelling features. If you produce design-intensive layouts, if you're new to drawing packages, or if you enjoy working with transparent layers, CorelXara will be a good addition to your toolbox.

CorelXara 1.5. List price: \$289. Requires: 486-based PC or better, 8MB RAM, 8MB hard disk space, Microsoft Windows 3.x or later or Windows NT 4.0. Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-3733; fax, 613-761-9176; www.corel.com. Circle 443 on reader service card.

Entry-Level Illustration Tools

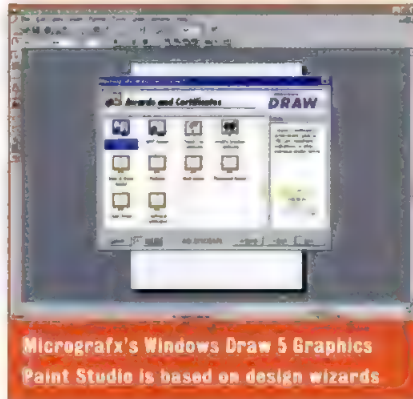
By Daniel B. Levine

Unlike beginner desktop publishing or photo-editing applications, which offer a generic set of the most commonly used editing tools, beginner drawing packages are generally tailored to specific tasks, such as flowcharting or technical drawing. The skills required for free-hand Bezier curve drawing are hard-won, even for professionals, as are basic drawing concepts such as layering. Also, the difference between raster and vector-type graphics are lost on most beginners, and they may not know when to use which package for what task. For these reasons, beginners should try to match their goals with an application and only move up to a full drawing package when they are ready.

For most simple illustrations, beginners should be able to make do with software they probably already own. The Microsoft, Corel, and Lotus office suites all include drawing tools in their word processing and presentation modules, as well as collections of clip art. Microsoft Office 97 introduces a new pan-application drawing taskbar that provides quite a few nice options for easily creating drawings, logos, and text. In addition, its AutoShapes feature can create many common shapes and even

flowcharting symbols (which can cast shadows or even be "extruded" to look three-dimensional), and its WordArt gallery provides interesting and colorful text styles for use as headlines or labels.

For more technical tasks, consider a diagramming program such as Micrografx's **FlowCharter 7**, (\$299 list; \$349.95



list for entire Micrografx Graphics Suite 2; 800-676-3110, www.micrografx.com) or Visio Corp.'s **Visio Professional 4.5** (\$350 street; 800-248-4746, www.visio.com). If you're interested in getting into the CAD arena, there are several accessible packages, including Autodesk's **AutoCAD LT** (\$490 street; 800-964-6432, www.autodesk.com) or ViaGrafx's forthcoming **Design CAD 97** (\$500 street; 800-233-3223, www.viagrafx.com).

there is no kerning, we were glad that text on a path seemed smart and did not create overlapping characters. When we imported an Adobe Illustrator file, we ended up with graphics but no text, and Expression does not import EPS files such as our SoundBoard logo. In addition, Expression doesn't let you set a scale, create guidelines, or draw dimension lines; you can't determine the actual size of an object or the distance between objects. Expression simply does not support technical illustrations.

Expression's color management is limited to calibrating its color match system to that used by Adobe Illustrator and older versions of Photoshop and CorelDraw. While you can print directly from Expression, Fractal Design recommends creating

Home users looking to make blueprints for improvement projects, such as building a deck or new kitchen, should examine **Planix** and **Draftix** products from SoftDesk (\$49 to \$59 list; 800-231-8574, www.softdesk.com), Books That Work's **Visual Home** (\$39.95 list; 800-242-4546, www.btw.com), or Broderbund Software's **3D Home Architect, Edition 2** (\$60 list; 800-521-6263, www.broderbund.com/3dhome).

Looking for more power? There's always **CorelDraw**—Version 5 (\$299 list), that is. Corel Corp. consistently keeps an older version of its powerhouse drawing product on the market, which sells at a substantial discount compared with the current version. CorelDraw 5 is a good choice if you're looking for a powerful illustration program for Windows 3.1.

We also enjoyed using Micrografx's **Windows Draw 5 Graphics Paint Studio** (\$50 street; 800-330-4976, www.micrografx.com), which supplies many wizards for filling in custom detail in pre-made projects. Micrografx supplies a CD-ROM's worth of banners, certificates, business and greeting cards, maps, and many other signs and documents. Users can create quite a few documents in Windows Draw that would normally call for a desktop publishing application.

bled a creature. Expression created the "in-between" frames, each of which you can use as a stroke. You can output these Multi-view Strokes as animations via .AVI files or sequentially numbered bitmaps.

Since Expression doesn't have any extrude tools, we created the three guitars for our spread by using some of the supplied Natural Media Strokes that resemble watercolor, oil, or ink brush strokes. All strokes can be given a degree of transparency, but Expression does not support bitmap files as objects or fills.

Unlike all the other programs in this roundup, Expression supports only artistic and not paragraph text. We had to type our text directly in Expression and could set only font, justification, and leading. Since

a bitmap of your image and bringing it into one of these other packages for output to a printer if you're generating CMYK separations. We printed directly from Expression, allowing it to rasterize our image at 200 dpi (in order to preserve transparency) before sending it to the printer. Expression took a few times to get the black plate right.

We were disappointed with the minimal direct support for Web output. We would have liked to produce animated .GIFs from Expression's Multi-view Strokes but could produce only sequential JPEG files. In fact, there isn't any .GIF export, but Expression beautifully executed the JPEG we did export.

As a paradigm breaker, Expression is a resounding success. It probably won't fulfill

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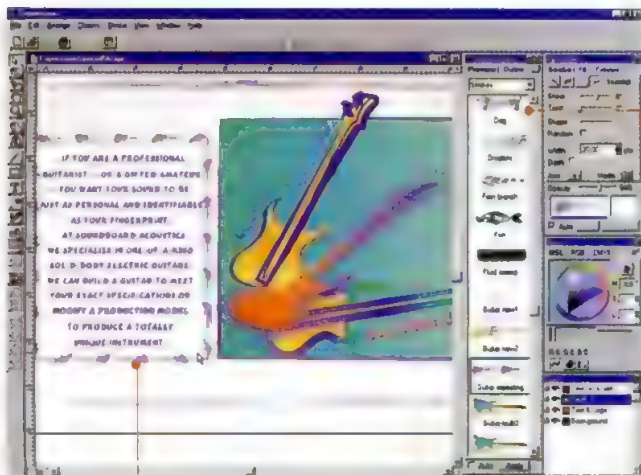
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Illustration



To draw in Fractal Design Expression, you place strokes on a skeletal frame. Outlines are paths on which strokes can be applied, letting you create distinctive effects with vector graphics.

all your vector graphics needs, but it's an essential tool. Since Expression exports beautiful bitmaps at any resolution and all the other illustration packages in this roundup now import bitmaps, it should be a great addition to any set of tools.

Fractal Design Expression 1.0. List price: \$449. Requires: 486-based PC or better, 12MB RAM, 21MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Fractal Design Corp., Scotts Valley, CA; 800-846-0111, 408-430-4100; fax, 408-438-9670; www.fractal.com. Circle 444 on reader service card.

Macromedia Inc.

Macromedia FreeHand 7

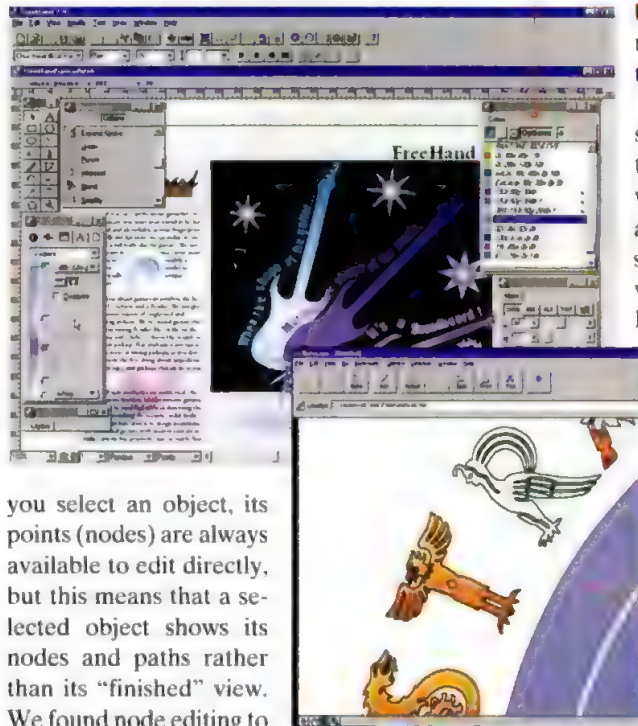


With perfect output to the screen, four-color CMYK printing, and several formats for the Web, Macromedia FreeHand 7 thoroughly impressed us. Because it always displays colors the way they will print, FreeHand was the only program in the roundup that made it impossible, thankfully, to create or assign colors whose printed versions would be dramatically different from their on-screen representations. This reliable print output—critical to design professionals—is what earned FreeHand our Editors' Choice.

The colors list in FreeHand (\$400 street) shows only the colors you have used or created. It allows you to pick colors from

other programs. Xtras utilize Macromedia's plug-in architecture, which allows third parties to add features on an Xtra menu but rarely integrates them into the program. We finally found a color eyedropper; it was on the Xtra Tools panel, not on the Color Mixer or Color List.

FreeHand's text and drawing tools are adequate but limited. The FreeHand interface favors node editing over overall object editing. Scale, rotate, reflect (mirror), and skew operations—which are all handled in CorelDraw by manipulating the object bounding box—each require a different tool from the FreeHand toolbox. When



you select an object, its points (nodes) are always available to edit directly, but this means that a selected object shows its nodes and paths rather than its "finished" view.

We found node editing to be acceptable, but the kinds of nodes are limited to corners, curves, and connectors.

Expression's Natural Media Strokes add detail and texture to the outlines of objects. You can save strokes as custom strokes.

libraries including Pantone and Hexachrome for printing, and from a Web palette optimized for both Macs and PCs.

We used an included Xtra to add and name all the colors from an imported bitmap to our color list, a feature unavailable in

other programs. Xtras utilize Macromedia's plug-in architecture, which allows third parties to add features on an Xtra menu but rarely integrates them into the program. We finally found a color eyedropper; it was on the Xtra Tools panel, not on the Color Mixer or Color List.

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Macromedia FreeHand 7 is a true WYSIWYG design environment. The program will not let you create or assign colors that print differently from the way they appear on-screen.

by letter—an effort made useless as soon as you have to edit the text.

FreeHand lacks tools specially designed for technical illustration. We weren't able to set a scale, and we couldn't see the size of an object while we were creating it. And FreeHand doesn't come with any dimension or parallel lines.

Macromedia's Shockwave Graphics allows you to view and magnify an image from within your Web browser with perfect resolution, if not always perfect rendering.

Output for the Web, including .GIF and JPEG file export, was perfect, but we weren't able to specify dithering or

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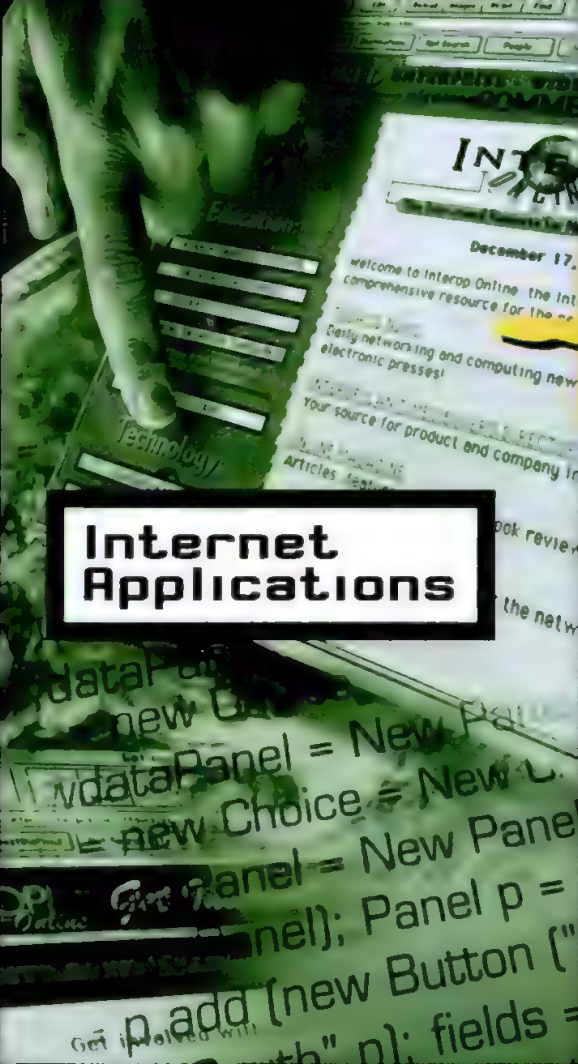
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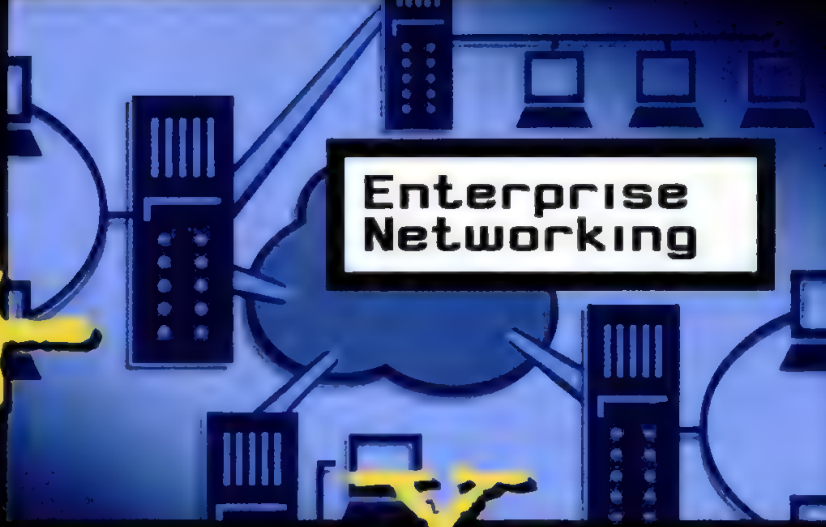
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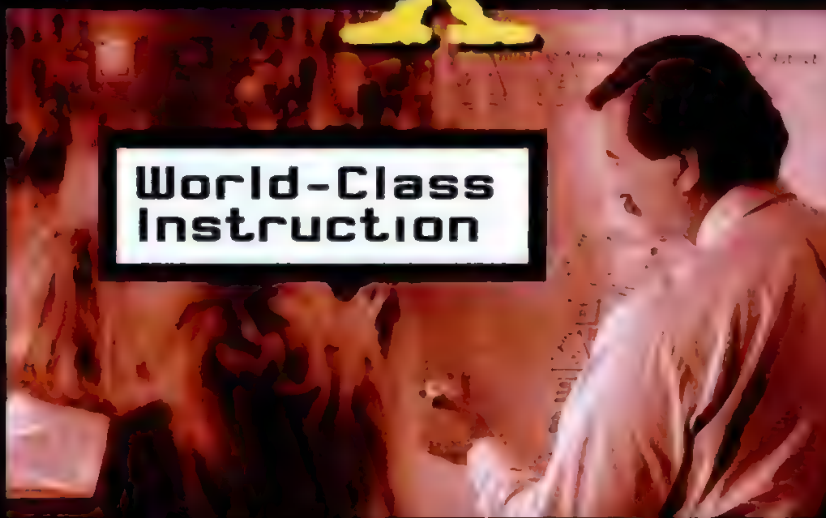
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determine the color palette. With a little bit of code specifying a toolbar position and window size, you can embed Macromedia's Shockwave Graphics' compressed FHC format into an HTML page. URLs assigned to objects in FreeHand provide visual hyperlinks without image maps. While CorelXara's Web format uses a right mouse click to access controls, the Shockwave toolbar provides a hand for repositioning the image and magnifying glasses for increasing and decreasing details. An Afterburner Xtra handles file compression, which ranged from 30 to 75 percent on our tests.

FreeHand's tools are well rounded, if not the best of the breed. But the true strength of FreeHand is that its output is absolute WYSIWYG without any nasty surprises.

Macromedia FreeHand 7. Street price: \$400. Requires: 486-based PC or better, 12MB RAM, 25MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Macromedia Inc., San Francisco; 800-288-4797, 415-252-2000; fax, 415-626-0554; www.macromedia.com. *Circle 445 on reader service card.*

Micrografx Inc.

Micrografx Designer 7

A pleasant-to-use if not extensive program that was able to complete most of our tests quite easily, Micrografx Designer 7 also deserves special distinction for its technical drawing skills. Along with FlowCharter 7, Designer 7 and Picture Publisher 7 form the core of the Micrografx Graphics Suite, one of the least expensive programs in this roundup at \$349.95 list.

Among the products tested, the drawing tools in Designer are some of the easiest to learn and use. A context-sensitive ribbon bar at the top of the screen provides buttons for creating and editing lines, curves, stars, and even "curvygons." The extrusion tool added depth and lighting to our guitars; standard skew and rotate allowed us to position them in 3-D space. The object format dialog box provided refreshingly large icons and sample areas for interior fills, line styles and fills, text, and object characteristics such as name, size, and location. Unfortunately,

the object format box sometimes failed to show our object's fill and then inappropriately applied the default fill along with our font changes.

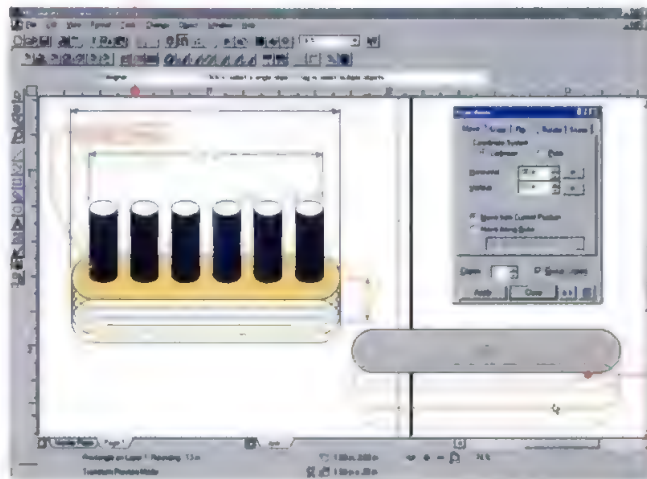
Text on a path created an invisible copy of the original path. While we could edit the invisible path and the text would reflow, it would

importing an Adobe Illustrator file. And Designer doesn't produce color separations or any on-screen color correction.

However, Designer comes with interesting bitmap filters and effects, and it used OLE to let us edit pixels in Picture Publisher. Designer produced good undithered .GIF files, dithered .GIF files that looked like basketweaving, and a JPEG anomaly that looked like bubbles. Designer also lets

you attach URLs to objects for use with Micrografx's QuickSilver 3 browser plugin. QuickSilver allowed us to zoom in and out of an image, but we couldn't reposition the image inside the frame, as we could with CorelXara's plugin or with Macromedia's Shockwave.

The toolbars in Designer 7 are clearly modeled after those of Microsoft Office, making it a good choice for business graphics.



Micrografx Designer 7's robust technical tools allowed us to preview the results of creating multiple copies that were a set distance apart.

not reflow with changes to the visible object we started with. Like CorelXara, Designer does not provide a text edit window, forcing you to edit in WYSIWYG mode all the time. Movement between layers is kludgy, and although you can have multiple pages of different sizes, you must use the Clipboard to move objects between pages.

POWER TOOLS

A technical drawing tool enabled us to create an array of multiple objects the same distance apart and showed us the result before we accepted it. We created multiple snap points for easily formatted dynamic dimension lines. The unique Reference Point allowed us to set constraints to x and y distances and an angle value, or to force placement of all objects at a selected distance from the point.

While Designer 7 provides most of the features—such as interactive blends—that prior versions lacked, we did find bugs: Hiding and unhiding an object resulted in lost text formatting, for example, and text flow around an object produced unacceptable hyphenation of words. Snap-to guides worked only when we resized an object, not when we dragged it. Also, Designer improperly imported our EPS logo and converted CMYK colors to RGB colors when

What makes QuickSilver special is that you can assign properties to vector graphics. We selected a guitar, then used menu choices to make a text box appear whenever we placed the mouse over the guitar. Another menu choice made the text box hide when we moved the mouse off the guitar. You can create animations by spinning objects or cycling objects by changing which one is on top. The result is a scheme that allows anyone to produce interactive Web applications easily.

For many everyday office graphics needs, Designer 7 does a good enough job with an easy-to-use interface, but the basic nature of the tools and the minimal support for CMYK printing may deter graphics professionals. But if you need a powerful tool for technical drawing or would like to put interactivity on your Web pages without programming, this might be the program of choice for you. □

Micrografx Designer 7. List price: \$349.95 (as part of Graphics Suite 2). Requires: 486-based PC or better, 8MB RAM, 9MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Micrografx Inc., Richardson, TX; 800-676-3110, 972-234-1769; fax, 972-234-2410; www.micrografx.com. *Circle 446 on reader service card.*

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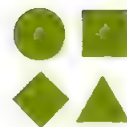
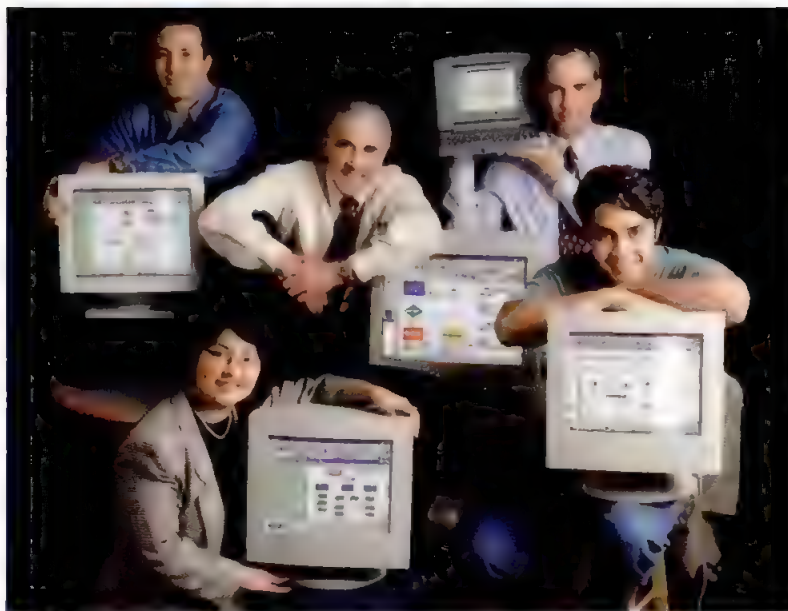
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Creating Component-Based Software Gets Easier

Take the pain out of building ActiveX controls.



By John Lam

Write once, deploy anywhere—anywhere, at least, that uses Microsoft Windows and an Intel CPU. That's the siren song of ActiveX controls, which have ushered in a new era of component-based software. Users of ActiveX controls have been realizing the benefits of this component architecture for almost two years. With dozens of applications that can use ActiveX controls and thousands of commercially available controls, software developers now have a wealth of prebuilt, pretested components for tackling their development problems. Until now, however, the developers who actually create ActiveX controls have had a very small set of tools—for C++ developers only—to choose from: either the raw ActiveX SDK (or the Win32 SDK) or the somewhat

IN THIS SECTION



POWER PROGRAMMING

If you want your program to have access to shared memory in Windows 95, you need to know about a technique called *file mapping*. This approach differs greatly from that used by Windows 3.x. A memory-mapped file can be viewed through a window in its address space, and its contents can be manipulated as though the whole file were loaded in memory. Using a special handle for a memory-mapped file, a developer can create a block of shared memory that can be accessed by any program in the system. *Page 207.*



INTERNET TOOLS

Internet cookies have caused a stir in recent months because of their capability of gathering information about users who surf the Web. Another concern is that the cookies are stored on the users' own hard disks. Find out what the intended purposes of cookies are, how they work, and exactly how much of a threat they pose to your anonymity and your computer's security. *Page 211.*



UTILITIES

In the good old days of DOS, you could send the image on your screen to the printer, using only a single keystroke. Although Windows 95 can capture the screen to the Clipboard, our utility of this issue, PrintNow, brings back the immediacy in screen printing that was available under DOS. PrintNow is a 32-bit Windows 95 application that runs in the background waiting for you to hit the **PrtSc** key. *Page 215.*

ALSO IN THIS ISSUE In PC Solutions we explain how to extract Windows 95 system files using a batch file, provide a faster way to access frequently used folders, tell you how to clean up the Add/Remove programs list, show you how to disable Access's AutoExec bypass key, and much more. *Page 219.*

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more comfortable environs of the Microsoft Foundation Class Library.

That there were so few tools is surprising. ActiveX controls are built on top of the language-neutral Component Object Model (COM), which defines a *binary* standard for interobject communications. Therefore, in theory, you could create a COM object using any programming language able to create objects that conform to the COM binary standard.

Fortunately, the recent interest in using ActiveX controls for deploying Internet and intranet applications has elicited fresh competition among development tool vendors. In this article, we will look at three promising new products for creating ActiveX controls. Microsoft Visual Basic 5.0 Control Creation Edi-

The ways in which developers handle user-input errors vary. Poorly designed applications throw the error back into the user's face by putting up a modal dialog box (one that must be dismissed before the application can continue) informing the user of the error in no uncertain terms. The application then erases the user's entry in the text box, forcing him to try again.

An elegant alternative is presented in Alan Cooper's book on graphical user interface design, *About Face*. Rather than deleting the erroneous input, berating users with a dialog box, and forcing them to enter the information again, the application instead should provide some kind of visual cue that the input needs attention, perhaps by changing the background color of the text box to something that will stand out against the background. The user can choose to handle the problem right away or at a more convenient time.

Our ActiveX control is a text box that reflects this design goal. We will use a single custom property and a single custom event. The custom property will store the color that indicates the error condition, and the custom event handler will pass two parameters to

the application when the keyboard focus leaves the control. The first is a string containing the contents of the text box, and the second is a Boolean that tells the control whether its data is valid. The control inspects the Boolean variable, sets the background color of the text control to the error color upon a validation failure, and resets the background color of the text control to the original background color upon a validation success.

The data validation functionality of the controls built with each of the tools is identical, but not all properties and events will be supported in each case. With Visual Basic and Delphi, we are building on top of a preexisting control in their respective libraries. In the case of the ActiveX template library, we are literally building a control from scratch, so in the interest of brevity, we won't add all of the other controls' fancier properties.

Microsoft Corp.

ActiveX Template Library

Version 2.0 of the ActiveX Template Library (ATL) now supports the creation of ActiveX controls (for a look at the previous version of ATL, see my Power Programming column of December 3, 1996). The first version of ATL supported the creation of nonvisual COM objects only. The new version adds support for the creation of ActiveX controls, standard Win-

dows dialogs, and ActiveX property pages.

ATL, like MFC, eliminates most of the nitty-gritty details of creating ActiveX controls. Also similar is that both class libraries assume you know the fundamentals of the ActiveX control architecture. ATL 2.0 is an excellent tool for creating ActiveX controls from scratch. Control size and performance have been highly optimized.

Unlike MFC, ATL produces very compact ActiveX controls, which have the smallest footprint of any produced by the tools we will look at in this article.

ATL 2.0 for Visual C++ 4.2b is free and should be available for download from Microsoft's Web site (www.microsoft.com/visualc) by the time you read this. (In fact, ATL projects should compile using any compiler that supports templates and the new C++ style casts.) Visual C++ 5.0 will include ATL 2.0, with improved wizard support. Both versions generate your controls using the same set of source code files. In this article, we will look at ATL 2.0 for Visual C++ 4.2b.

WIZARDS SET THE STAGE

Three wizards simplifying the initial creation of your ActiveX controls ship with ATL for Visual C++ 4.2: the Project Wizard, the Object Wizard, and the Proxy Generator. By taking a set of options that you specify, and generating your project file and some core source-code files, the wizards get you up and running quickly.

Your first step in creating a new ActiveX control is to run the Project Wizard (Figure 1), which provides a number of options relating to your ActiveX project. You can choose whether to house your project in a dynamic link library (an in-process server), a standard

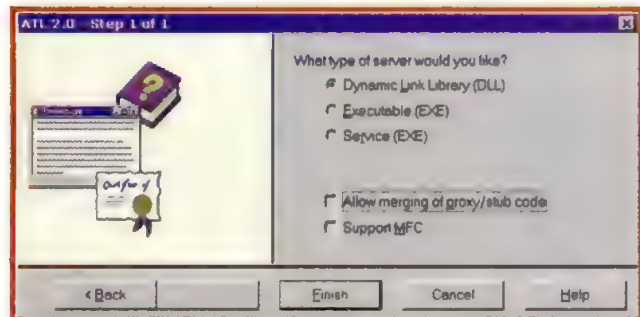


FIGURE 1: You can use the ATL Project Wizard to set up your ActiveX project options: the type of server, whether you are using remotable interfaces, and whether you want to add support for MFC.

tion and Borland's Delphi 3.0 are standalone products, and the Microsoft ActiveX Template Library 2.0 is a class library that must be used in conjunction with Visual C++ 4.2b or 5.0.

We will compare these tools by creating a reference ActiveX control. We will walk through the mechanics of creating an ActiveX control using each of the products, noting the good and bad aspects of each as we move along. Then we'll wrap up the comparison by offering some recommendations about where and how to use the various products. Since these tools are targeted at different segments of the developer market, they reflect the experiences and strengths of the developers in those segments. Software development is not unlike any other profession: the tool to choose is the one that fits the job.

OUR TEST-BED: A VALIDATED TEXT BOX

Validating user input is a common problem developers encounter in creating form-based applications. Our test-bed control attempts to solve this problem with a novel twist. Many applications validate a user's input as soon as the keyboard focus leaves an input field. The focus typically changes when the user presses the Tab key or clicks on another field using the mouse. Developers typically write their validation code in an event-handling procedure that is called by the control when the control loses focus.

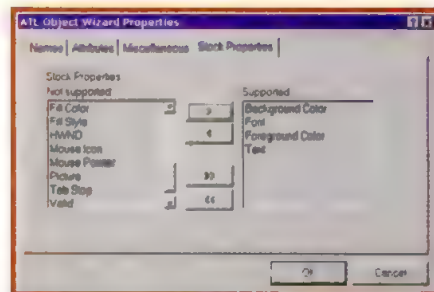


FIGURE 2: Use this pane of the Object Wizard to select the stock properties to include in your ActiveX control.

Windows executable file (an out-of-process server), or a Windows NT service. As we will be creating an ActiveX control, we will choose the dynamic link library (DLL) option.

The Project Wizard also offers options relating to remotable interfaces and support for MFC. Since we are building an in-process server, we don't need to concern ourselves with the remotable interface code generated by the ActiveX project file. Also, since we won't be using MFC in this project, we can

Building ActiveX Controls

leave that option unchecked as well. Click on Finish and the Project Wizard will generate the skeleton project file.

Our next step is to run the Object Wizard (Figure 2), which allows you to insert additional files into an existing Visual C++ project. You can add as many ActiveX controls and COM objects as you wish to your ActiveX project, and you can create different kinds of objects that can be housed within the same ActiveX server. You can create a COM object (the nonvisual cousin of an ActiveX control), a minimal ActiveX control that can run only inside Internet Explorer 3.0, or a full-fledged ActiveX control. The Object Wizard also allows you to create dialog boxes and ActiveX property pages. To get started, select Component from Developer Studio's Insert menu. Then click on the ATL pane and choose the Object Wizard. Select the Full Control option, and click Next to continue.

Wizards usually present a series of dialog boxes with Next and Back buttons. The ATL Object Wizard, however, presents an awkward multipaned user interface. It's easy to forget to enter some information on a pane and bypass it completely if you click on the OK button before you are finished setting your options.

We'll enter the name of our ActiveX control in the first pane, and the wizard will fill in all of the details regarding the class name, its Programmatic ID, the source-code filenames, and so forth. The second pane contains a number of attributes concerning interface types and the threading model that will be used by ATL. Leave these settings at the default values.

The third pane is of particular interest to us. It allows us to instruct ATL to superclass the Windows Edit class for use by our control. Since the Windows Edit class already implements most of the functionality of a text-box

specification. The properties we're interested in are Background Color, Foreground Color, Font, and Text. ATL provides default implementations for all of these properties, so in general you can simply select them and assume that your control will know how to deal with them. Click OK to complete the creation of your first ActiveX Control.

WHAT THE WIZARDS DON'T DO

Wouldn't it be great if wizards could create the entire control for you? But they don't, at least not yet. In order to develop a custom ActiveX control, you will have to concern yourself with at least some of the following: properties, events, and persistence. In the interest of space, however, we'll defer the detailed discussion of the code required for creating an ActiveX control from scratch using ATL to a future column. The source code for our ATL test-bed control is available for download now, if you want to take a look at how you can implement your own ATL control. The comments in the source code should give you a head start in creating your own ATL ActiveX controls.

SUMMING UP ATL

To use ATL, you must already know a fair amount about Win32 programming, C++, and the role of the various COM interfaces used by an ActiveX control. ATL is definitely not the tool to choose if you are unfamiliar with any of these technologies.

On the plus side, ATL generates the smallest ActiveX controls, if you consider the total size of the control plus the runtime library. When compiled for minimum size, our sample ActiveX control (which includes an ActiveX property page) weighs in at a svelte 44K, and requires a runtime library (ATL.DLL) of only 21K, for a grand total of only 65K.

Most of the code I had to create for our sample control dealt with general Windows control issues. The rest consisted of bookkeeping code for instructing the ActiveX template library how to handle the control's implementation details. As far as class libraries are concerned, the ActiveX template library is among the most elegant implementations. Through clever usage of C++ language features, ATL places a huge amount of power in the hands of a seasoned developer.

Microsoft Corp.

Visual Basic Control Creation Edition

Whereas ATL 2.0 allows you to access the most intimate parts of an ActiveX control, Visual Basic 5.0 Control Creation Edition insulates you from the intricate details of ActiveX control creation. Although you do have the option of building ActiveX controls from scratch, developers using VB are more likely to extend the

functionality of an existing ActiveX control.

VB's ease of use is largely due to the power of the ActiveX Control Interface Wizard (Figure 3). The wizard takes care of all the details of adding stock as well as custom properties and events. You don't have to worry about bookkeeping code, since the wizard takes care of it for you.

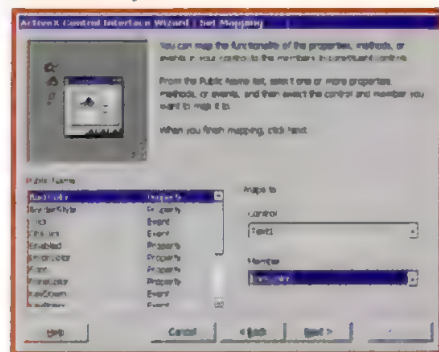


FIGURE 4: The Control Interface Wizard lets you easily map your User Control's properties and events to properties and events of ActiveX controls contained inside User Control.

VB introduces the concept of a *user control*, which acts as a container for other ActiveX controls. The idea behind the user control is that users can drop whatever ActiveX controls that they want onto a user control "form" and use the ActiveX Control Interface Wizard to map the user control's events and properties to those of the contained controls. This very powerful development idiom is similar to the way form-based applications are created by VB developers today. Most VB developers should have no trouble learning to create new controls using VB5CCE.

Visual Basic 5.0 Control Creation Edition is a subset of Microsoft Visual Basic 5.0. It is available free of charge from Microsoft's Web site (www.microsoft.com/vbasic). Only customers who purchase Visual Basic 5.0, however, are entitled to product support from Microsoft. Peer-to-peer public support is available in the newsgroup microsoft.public.vb.controls.creation.

To begin creating our test-bed ActiveX control, just start up VB and select ActiveX Control from the list of project types. Draw a text box on your user control's form and you're ready to go!

THE ACTIVEX CONTROL INTERFACE WIZARD

In VB 5.0, as in ATL 2.0, wizards are instrumental in reducing the amount of work necessary to create ActiveX controls, and the one we'll interact with most is the Control Interface Wizard.

On the first page of the Control Interface Wizard, you can select which stock properties, methods, and events to add to your user control, and VB provides the implementations. For our test-bed control's stock properties, we will select Back Color, Font, Fore Color, and Text.

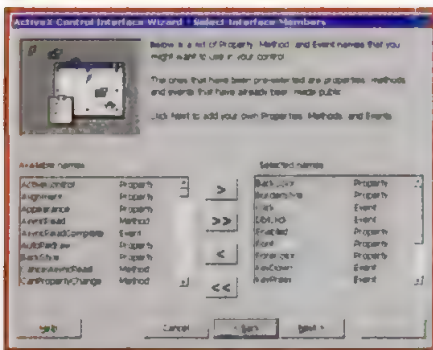


FIGURE 3: Visual Basic 5.0 Control Creation Edition's ActiveX Control Interface Wizard. Use this page to select which stock properties and events the new control should support.

control, that greatly reduces the amount of work we have to do.

Our final task in the Object Wizard is adding a number of stock properties to the control. *Stock properties* are those whose behavior is predefined by the ActiveX control

The next pane allows you to add custom properties, methods, and events to your user control, just by entering their names. For our control, we'll add a new property called `ErrorColor` and a new event called `Validate`.

In the third pane (see Figure 4), you can map the properties and events of your user control to the properties of the contained controls. This eliminates much of the drudgery involved in exposing properties and events for controls that are contained inside the user control. Just map the `BackColor`, `Font`, `ForeColor`, and `Text` properties of the user control to those same properties of the contained `Text` control.

The final pane of the Interface Wizard allows us to enter the details of our custom property and event. We want our `ErrorColor` property to be an `OLE_COLOR` property, which is read/write at both design and run

time. We want our `Validate` event to be a `USER_DEFINED` event. In the fourth pane, we enter the code to fire the `Validate` event:

```
Dim fValid As Boolean
RaiseEvent Validate(Text1, fValid)
If fValid Then
    Text1.BackColor =
        m_CurrentBackColor
Else
    m_CurrentBackColor =
        Text1.BackColor
    Text1.BackColor = ErrorColor
End If
```

The line beginning with `RaiseEvent` fires the event. Then we inspect the return value of `fValid` and set the background color appropriately.

The variable `m_CurrentBackColor` holds onto the current background color for the control. It's declared as an `OLE_COLOR` variable, is initialized to the current background color in the `InitProperties` event handler, and is set to the new background color in the `BackColor` Property Let handler. (For complete details, the full source code for the control is available from PC Magazine Online.)

SUMMING UP VISUAL BASIC 5.0 CCE

We have just created our first VB5 control! Wasn't that simple? We needed only 14 lines of custom code, in addition to the wizard-generated code.

VB allows developers to leverage what they already know about assembling existing components into a form-based application. The only new concept here is that the "form" (user control, in this case) can have custom properties, methods and events that can easily be mapped onto the components contained within the user control.

VB also generated the smallest control of any tool in our roundup: 18K. Bear in mind, however, that the VB control requires the Visual Basic Virtual Machine DLL (`MSVBVM50.DLL`) to be present on your user's machine. The DLL's current size is 1.3MB.

Borland Delphi

The latest version of Delphi, Version 3.0, now fully supports the creation of ActiveX controls. With the addition of a full complement of ActiveX Experts (Figure 5), Delphi makes it easy to create new ActiveX controls, property sheets, forms, type libraries and nonvisual COM objects. Delphi 3.0 should be shipping by the time you read this. As we go to press, pricing and availability have yet to be announced. Borland's Web site (www.borland.com) should have details.

Delphi developers have always been able to create their own custom controls by building on the foundation provided by Delphi's Visual Component Library (VCL), and the value of the skill set required to create new VCL components is not lost with this latest version of Delphi; you can create ActiveX controls from any existing VCL component.

Figure 6 shows Delphi's new ActiveX Control Expert for creating ActiveX controls. Simply by specifying the name of the VCL component class that you wish to use, the Expert will generate a set of source code files that you can compile into an ActiveX control.

CREATING OUR REFERENCE CONTROL

Delphi, like VB, allows you to build on a foundation provided by the controls that ship with the tool. But Delphi's method is different. Whereas VB relies on object composition to extend an existing control, the VCL allows you to derive a new control from an existing one. Both methods allow developers to accomplish the same goal: to reuse existing functionality.

Delphi's Component Expert lets you quickly generate a skeleton control. We will create a new control from the VCL's `TEdit` component.

Adding properties to a Delphi project is very simple. Just add a new property declaration to the published section of your component's class declaration:

```
property ErrorColor: TColor read
    Get_ErrorColor write
    Set_ErrorColor;
```

We have to add a couple of functions to read and write the `ErrorColor` variable, which is defined as `ErrorColor: TColor`.

```
function
TValidEdit10.Get_ErrorColor: TColor;
begin
    Result := FErrorColor;
end;
procedure TValidEdit10.Set_ErrorColor
( Value: TColor );
begin
    FErrorColor := Value;
    FCurrentColor := Value;
end;
```

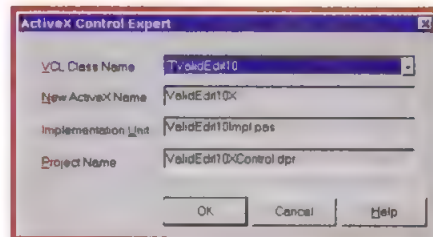


FIGURE 6: Delphi 3.0's ActiveX Control Expert allows you to turn any VCL component, including custom components you can create, into an ActiveX control.

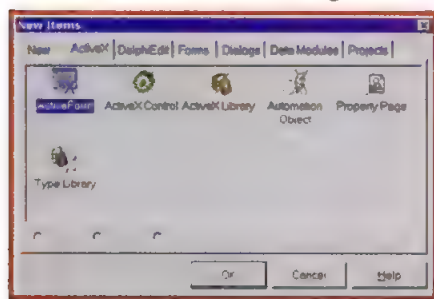


FIGURE 5: Delphi 3.0's new ActiveX Experts make creating new ActiveX controls easy.

time. Our `Validate` event will pass a string parameter called `Text` by value and a Boolean parameter called `Valid` by reference.

Click `Finish` to let the wizard generate the code for you. The great thing about the Control Interface Wizard is that you can use it as many times as you want. You can add new properties, edit existing properties, or delete properties at any point in your project.

ADDING CODE

We need to add only two pieces of code to our wizard-generated control. The first involves resizing the contained text control, and the second is concerned with firing our `Validate` event.

The user will resize our text control after drawing it on the form. To ensure that the text control inside our control is resized correctly, we have to write a little bit of code in the `Resize` event handler of our user control:

```
With UserControl
    Text1.Move 0, 0, ScaleWidth,
    ScaleHeight
End With
```

The second bit of code we have to add will trigger the `Validate` event. Since user controls in VB are designed to hold more than one ActiveX control, the interpretation of the focus event probably differs a little from what you're used to. VB lets you assign an internal

Building ActiveX Controls

To add our Validate event handler is almost as straightforward. An important concept in Delphi is the *method pointer*, a pointer that contains information about the name of the method that is being invoked as well as the object that is being invoked.

The first thing we must declare is the type of our method pointer:

```
TValidateEvent = procedure( Sender:
TObject; Text: String;
var Valid: Boolean ) of object;
```

This is the same event-handler declaration we've seen in our other test-bed controls. The Text property is passed by value as a string, and the other parameter, a Boolean called Valid, is passed by reference.

Inside our component, we also need a declaration of our method pointer:

```
FOnValidateEvent: TValidateEvent;
```

and we must declare our Event property in the published section of our class:

```
property OnValidate: TValidateEvent
read FOnValidateEvent write
FOnValidateEvent;
```

The data member FOnValidate is set at design time by the property inspector to point to the appropriate event handler in your Delphi project.

The final item we must add to our new Delphi component is the code that actually fires the Validate event when the focus leaves our control. We can do this by intercepting Delphi's DoExit event trigger by overriding the dynamic function DoExit in our derived class:

```
inherited DoExit;
if Assigned( FOnValidateEvent )
then
begin
DoValidate( Self, Text, Valid );
if Valid then
begin
Color := FCurrentColor;
end else
begin
FCurrentColor := Color;
Color := FErrorColor;
end;
end;
end;
```

In our code, we make sure that we call the inherited DoExit first. This ensures that any code that expects the DoExit event to fire will continue to work correctly.

To actually fire the Validate event, we call our own protected dynamic function, DoValidate:

```
procedure TValidEdit10.DoValidate
(Sender: TObject; Text: String; var
```

```
Valid: Boolean );
begin
FOnValidateEvent( Sender, Text,
Valid );
end;
```

By firing our Validate event via a protected dynamic function (which is similar to a virtual function), we ensure that anyone who wants to subclass our control will be able to intercept and modify the behavior of our Validate event.

The rest of the code is very similar to the

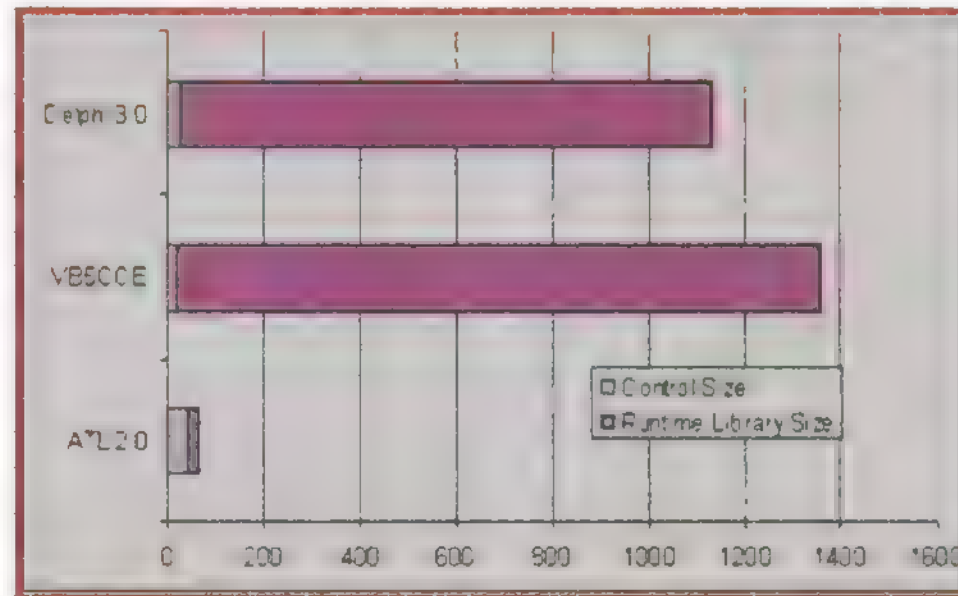


FIGURE 7: Comparison of the sizes of controls generated by the products in our roundup. Both the size of the control and the size of associated runtime libraries are shown.

code we wrote for Visual Basic and ATL; if the Validate event handler sets Valid to False, we set the background color to the value contained in FErrorColor.

CREATING AN ACTIVEX CONTROL

The foregoing describes the steps involved in creating a Delphi VCL component. To turn the component into an ActiveX control, just run the ActiveX Control Expert. Select the class name (TValidEdit10) of the component, and the expert will generate a set of new source-code files for you. Normally, you won't have to edit any of the expert-generated source code. Just compile the files to create your new ActiveX control.

SUMMING UP DELPHI

In about 30 lines of code, we have managed to create not only a VCL component, but a full-fledged ActiveX control. The clever use of experts in Delphi 3.0 makes creating ActiveX controls a snap. Even more important, it allows developers who are already proficient at creating VCL components in Delphi to distribute their VCL components as ActiveX controls.

Also significant is the fact that Delphi 3.0 objects *are* COM objects. You get the best of both worlds when creating ActiveX objects using Delphi. You have the ability to leverage an existing class library with over 100 prebuilt components, plus the ability to create and interact with native COM objects.

On the downside, Delphi 3.0 controls require the presence of VCL30.DLL on your user's

computer. This is not a small DLL, weighing in at just over 1.1MB. The actual control generated by the ActiveX Control expert is just 29K.

WHICH TOOL SHOULD YOU USE?

The tool that you should use should fit the job at hand. If you're creating ActiveX components for resale, then you must consider the licensing implications of extending someone else's control. While you may be allowed to redistribute such controls with your applications, you probably do not have the right to redistribute them

to other developers to incorporate into their applications.

In this case, you'll probably want to create a control from scratch, and that makes ATL and Delphi likely candidates for you to consider. Both of these tools give you access to the full power of the Windows API, allowing you to distribute your ActiveX controls as compiled native code.

You will also need to consider the size of the controls you'll be distributing. Figure 7 shows a comparison of the sizes of our test-bed control as generated by each of the

three tools discussed here. You should also pay attention to the size of the runtime libraries. While that may not be important in many cases, since the library has to be installed only once on a new computer, you may want to consider what the implications might be if you are creating your own controls for resale.

If you are creating objects that are going to interact heavily with other nonvisual COM objects, choose between Delphi and ATL. Keep in mind, however, the programming language the objects were created in and the language their header files are written in. If you are planning to interact with a large set of objects and interfaces, such as the Microsoft OLE DB SDK, you'll have to port their header files to Delphi or use ATL.

Finally, the tool should also mesh well with your experience as a developer. If you have little experience in creating components and want a quick-and-easy introduction to creating ActiveX controls, Visual Basic 5 Control Creation Edition is easily your best bet. You can't beat the price, and it's the quickest route to creating your first ActiveX control.

If you're fairly familiar with Windows API programming, C++, and the details of how ActiveX interfaces operate, then ATL offers the most power and flexibility. On the other hand, if your experience lies in creating VCL components, Delphi provides a one-step conversion tool to transform your components into ActiveX controls. In short, the right tool depends heavily on the knowledge and skills of the developer. □

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PC Tech/Power Programming

By Zan Oliphant

Windows 95's Shared Memory

Using a Win32 memory-mapped file, contained within a C++ object.

During my last software project, I was in need of a simple memory-sharing solution for multiple Windows 95 processes. Having never used shared memory under Windows 95, I consulted the documentation, looking for something similar to the Windows 3.1 API function `GlobalAlloc()`. I was surprised when I didn't find an obviously corresponding API function in Windows 95. `GlobalAlloc()`, although still supported under Win32, did nothing more than allocate memory from the local process heap. In fact, under Win32, there is no difference between `LocalAlloc()` and `GlobalAlloc()`. Both allocate memory from the local heap and are provided for source compatibility with older 16-bit code. With Win32, Microsoft gave developers the green light to use standard C runtime memory management functions such as `malloc()` and `free()`. In C++, `malloc()` is used indirectly through the new operator—all the more reason to use the C runtime for memory management.

I was happily using `malloc()` and `free()` for my dynamic memory requirements when a need for *shared* memory spoiled the party. After some more digging in the Microsoft Development Library, I found a number of articles on implementing shared memory using something called *file mapping*. File mapping lets a process view a file through a window in its address space. In other words, you can manipulate the contents of a file as if the whole file were loaded in memory. Windows handles the disk I/O for you—that is, loading the file from disk to memory.

Building on that concept, Microsoft decided to implement shared memory the same way. For shared memory, a developer maps a file with a value of `0xFFFFFFFF`. This special handle instructs Windows to map a view of shared memory backed by the *system paging file* rather than a specific file. The system paging file, or *swap file*, as it is often called, is the means by which Windows implements *virtual memory*, which allows applications to allocate and commit more memory than is physically present on the system. For example, if your system has 16MB of physical memory but the software (including operating system) requires 32MB, the remaining 16MB would be allocated on

the disk drive, rather than in memory.

The concept of virtual memory has been a familiar one for decades, and in light of that, I won't go into a lengthy discussion of how it works with Windows 95 and the 386-class processor. (Look to the Microsoft Development Library for many articles on this subject. Other good references are *Inside Windows 95*, by Adrian King, and *Systems Programming for Windows 95*, by Walter Oney.) For the purposes of this article—and in your own use of shared memory under Win32—you should know that virtual memory with Win32 is managed in 4,096-byte blocks called *pages*. Normally, as a Win32 developer, you're insulated from memory pages by using runtime

WINDOWS 95 ADDRESS SPACE

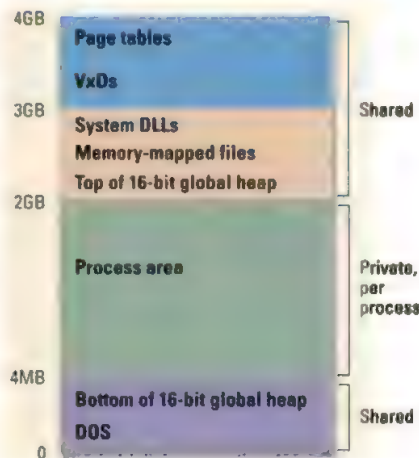


FIGURE 1: Windows 95's memory use over the entire addressable range of the operating system.

calls for memory allocation, but with file mapping, you need to know that the smallest allocation unit is 4,096 bytes. You can allocate less than a page for a memory object, but you would be wasting system resources, since a whole page would be used for such a request.

Before we go any further, it may be helpful for you to take a look at the depiction of Windows 95's address space in Figure 1. This map is a memory-use overview for the entire addressable range of the operating system. Notice that the highest address is 4 gigabytes. That corresponds to the maximum address-

ing capability of a 32-bit processor; all 32 bits set to 1 equals a number upwards of 4 billion (4,294,967,295, or 4GB). Working down from the top, you'll see page tables and VxDs. *Page tables* help Windows manage the memory pages mentioned above. A *VxD*, or *virtual device driver*, is a special kind of device driver that *virtualizes* a single system resource among multiple system clients. Below the 3GB mark, you can see where Windows stores its system DLLs, memory-mapped files, and the top of the 16-bit heap. Between 2GB and 4MB is the process area, where each Win32 process stores its code, data, and resources. Below 4MB is the bottom of the 16-bit heap, along with DOS.

Each process in Windows 95 has its own linear address range, or *memory context*, between 2GB and 4MB. Because this address range does not directly map to physical memory but is an index into the system page table, it is possible—and not unlikely—that two processes may use the same linear memory reference (let's say a pointer value of hex 400000) for entirely different sets of data. In contrast, the memory region between 4GB and 2GB stays the same for *all* processes—allowing each process to share, or *see*, the same system resources. That brings us back to using shared memory in Windows 95 with file mapping. Memory-mapped files are located between 3GB and 2GB.

In addition to sharing memory among multiple processes, I also wanted to contain that memory within a C++ object, so I could use the new and delete operators to gain access to the shared region. Knowing that I could override these operators, I set about making them handle shared memory with Win32 file mapping. The resultant C++ class included as an example with this article *must be allocated and deleted with these operators only*. If you allocate an instance of this class on the stack, or globally, you won't be using shared memory.

Another interesting note: Because the new operator for this class uses `CreateFileMapping()` to allocate memory, only the first process that calls it actually allocates memory. The same call to `CreateFileMapping()` in a subsequent process gives that process access to the same block of shared memory—nothing "new" about it. Because of this, you can't

use the C++ constructor to initialize data members of the class; if you were to do so, each subsequent instance of the class would wipe out existing data. Fortunately, the first call to `CreateFileMapping()` initializes the shared memory to 0. Our object's constructor and destructor serve only to increment and decrement a count of the number of processes using the shared memory area.

THE SAMPLE

For this article (you can get the source code from PC Magazine Online), I stripped down the C++ class (`CZanGMem`) to two data members: a process counter called `iProcessCnt` and a data area called `MyData`. The process counter is incremented in the constructor and decremented in the destructor. `MyData` is just a large buffer that represents whatever data members you may want to store in the shared memory object.

In the header file that defines `CZanGMem` you'll find the magic that overrides the standard C++ operators `new` and `delete`. A replacement `new` is declared like this:

```
void* operator new (size_t size)
{
    return ZanMemAlloc (size);
};
```

where a call to `new` is directed to a globally defined routine, `ZanMemAlloc()`. Similarly, the `delete` operator is overridden like this:

```
void operator delete (void* pvMem,
size_t size)
{
    ZanMemFree (pvMem);
};
```

Here, `delete` is directed to our new global `delete` routine, `ZanMemFree()`.

Use this technique of overriding the `new` and `delete` operators whenever you need to use memory management routines other than those provided by the C runtime library. For example, use `VirtualAlloc()` to commit memory that you had previously reserved (see *Virtual Memory Functions* in the Win32 Programmer's Reference).

As you can see below, the shared memory allocation routine `ZanMemAlloc()` is straightforward:

```
HANDLE hMapObject = 0;

//
// ZanMemAlloc
//
void* ZanMemAlloc (int iSize)
{
    if (hMapObject)
        return NULL;
    // Allow only one view per process
```

```
    hMapObject = CreateFileMapping
        ((HANDLE)0xFFFFFFFF,
        NULL,
        PAGE_READWRITE,
        0,
        sizeof CZanGMem,
        "CZanGMemShared");

    if (!hMapObject)
        return NULL;
    return MapViewOfFile (hMapObject,
        FILE_MAP_WRITE, 0, 0, 0);
}
```

First, `hMapObject` is checked, to make sure this is the first allocation attempt for this process. There would be no point in mapping multiple views of the same shared memory object in the same process. Once this check is passed, the Win32 API function `CreateFileMapping()` is called with a handle value of `0xFFFFFFFF` in the first parameter, to indicate a shared memory request. The second parameter is for Windows NT security attributes and is set to `NULL` for Windows 95. `PAGE_READWRITE`, the third parameter, specifies the protection required for the memory view—we allow full access by any process. After that come the high- and low-order `DWORD`s for the memory object's size. We use 0 in the high order and the size of `CZanGMem` (our global memory object) for the low order. Finally, a pointer to the name of the memory object, `CZanGMemShared`, is given so that other processes can access the shared object. Using this same code, the first process creates the memory object and later processes attach to it. Upon successful completion, the API call returns a handle to a file-mapping object.

Assuming `CreateFileMapping()` returns with a valid (nonzero) handle, we make a call to `MapViewOfFile()`. This API function maps our shared memory into the current process's address space. It also does the actual memory allocation, if needed. The handle to the file-mapping object is used as the first parameter. `FILE_MAP_WRITE` gives this process read/write access to the memory view. The next three parameters are intended for a file view, not for a memory view like ours. They specify the high-order 32-bit file offset, low-order 32-bit offset, and number of bytes to map within the file. Here we use 0 for all three values. Upon successful completion, the function returns the address of the shared memory, mapped within our current process. Otherwise it returns `NULL`. Either way, the return value from `CreateFileMapping()` is returned from `ZanMemAlloc()` and subsequently returned from the `new` operator.

Provided all has gone well with `ZanMemAlloc()`, we can call the `CZanGMem` constructor. As I mentioned earlier, we don't use the constructor in a normal fashion (for initializing class members). Below, you can see where the process count is incremented:

```
//
// Constructor
//
CZanGMem::CZanGMem ()
{
    iProcessCnt++;
}
```

When our process no longer requires access to the global memory, we use the `delete` operator to unmap it. This operator is overridden by our global routine `ZanMemFree()`. You can see the code for this routine below:

```
//
// ZanMemFree
//
void ZanMemFree (void *pvFree)
{
    UnmapViewOfFile (pvFree);
    CloseHandle (hMapObject);
}
```

A pointer to the memory object previously returned by `MapViewOfFile()` is passed to `UnmapViewOfFile()`. This informs Windows that our current process is done with its view of the shared memory. For proper cleanup, `CloseHandle()` closes the handle previously returned by `CreateFileMapping()`. When the last remaining process calls `ZanMemFree()`, our shared memory object is automatically deleted by the API function `UnmapViewOfFile()`. In light of that, the destructor is used in a nontraditional sense, in that it only decrements the process count:

```
//
// Destructor
//
CZanGMem::~CZanGMem()
{
    iProcessCnt--;
}
```

USING CZANGMEM

To try out this unconventional C++ class, I wrote a small console-mode Windows 95 application, which is included with the sample source code. Windows 95 console-mode applications look like DOS command line applications but are true Win32 applications. Console mode is perfect for testing software modules independently, without the complexity of windowing.

Below you can see `main()`, which allocates a `CZanGMem` object with the `new` operator, prints status information, and unmaps the object with the `delete` operator:

```
#include <windows.h>
#include <stdio.h>
#include "zangmem.h"
void main()
{
    CZanGMem* pZanGMem = new CZanGMem;
```


Power Programming

```

printf ("Process Count is %d\n",
pZanGMem->iProcessCnt);
printf ("CZanGMem Address is
0x%X\n",
pZanGMem);
printf ("CZanGMem Object Size is
%d",
sizeof CZanGMem);
getchar();
delete pZanGMem;
}

```

To run the sample program, double-click on Zangmem.exe within the Windows Explorer. You will see output similar to this:

```

Process Count is 1
CZanGMem Address is 0x82B89000
CZanGMem Object Size is 10004

```

While the first copy is still running, start another, and you will see the process count increase to 2. Kill one copy (hit Enter) and start another—the process count should still be 2, because the delete operator will decrement the count by one and the new operator will increment it by one.

In addition to the process count, the memory object's address and size are printed to your screen. Look at the hexadecimal address value: 0x82B89000. In hexadecimal, 2GB is

0x80000000 and 3GB is 0xC0000000, so this number is within the 2GB-to-3GB range. Looking back at Figure 1, you can see that this is as we would expect for a memory-mapped file view.

BEFORE YOU GO

I can't end this article without mentioning a much easier way to share memory between processes. You can use global data defined within a shared data segment. This will work in either an executable file or a dynamic link library. There are, however, some limitations with this technique. First, global data by definition is statically allocated at load time; you can't get any more memory as your program is running. Second, global data within a shared segment can be accessed only by other instances of the same program. For example, although two copies of Zangmem.exe can use this method, another program—let's call it Joegmem.exe—would not be able to view Zangmem's shared memory segment.

Even with the aforementioned limitations, shared segments are widely used under Win32—especially with system-level DLLs. In the sample code for this article, I have added a shared segment. First I created, and added to my project, a module definition file: Zangmem.def. Within that file is the following:

SECTIONS

ZanShare READ WRITE SHARED

The statement defines a shared segment called ZanShare, which can be read from and written to by any process—not just instances of Zangmem. To put data in that segment, you must use a #pragma directive before and after the global data:

```

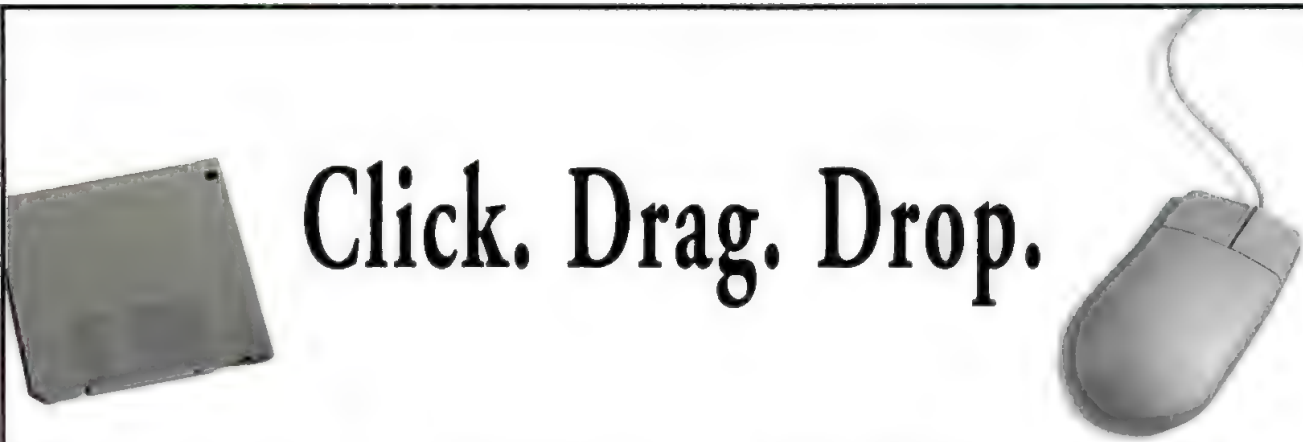
#pragma data_seg("ZanShare")
int iSharedSegCnt = 0;
#pragma data_seg()

```

(Note: This method is specific to the Microsoft compiler. Other compilers, notably Borland's, use a different technique to implement shared segments, but the concept is the same.)

In the sample code, you'll see how iSharedSegCnt tracks the process count just as pZanGMem->iProcessCnt does. □

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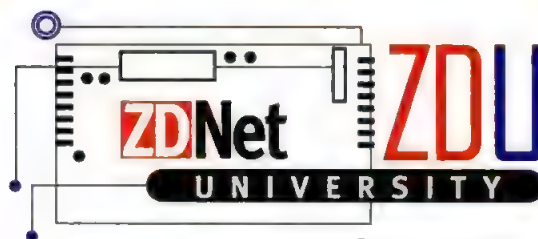
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PC Tech/Internet Tools

By Neil Randall

The New Cookie Monster

Everyone's afraid of cookies lately, but they can be good for you!

Ever wonder how your Web browser gets more knowledgeable about you all the time? You know: You head back to your favorite Web shopping site, and the stuff you crammed in your cart last time is still there, waiting for you to buy it or dump it. Or you head for other sites, and they seem to have a sense of your preferences, even remembering your user name and password. It's all very convenient, of course, because it saves you the bother of remembering and perhaps resetting such information. But in another sense, it's a little worrisome, because it implies that someone on the Web is keeping track of you and your actions.

Web sites accomplish amazing tracking feats through the use of persistent-client-state HTTP cookies. Netscape introduced cookies in Navigator 1.1. The specification is available on the Netscape site at home.netscape.com/newsref/std/cookie_spec.html.

A cookie is nothing more than a few lines of text that is part of an HTTP transaction. What's important is the way the information is used. When you click your way to a site that uses a cookie, the server transmits the cookie to your Web browser along with the rest of the HTML document you've requested. The browser stores the information on your hard disk. Then, when you head back to that Web site later—even in the same browser session—the cookie is transmitted back to the server that sent it to you in the first place, which may then send an updated cookie.

Why are they called *cookies*? There are several theories, including the official version from Netscape, which claims there's "no com-

elling reason." The most likely answer is that the name derives from Unix *tokens*, which are also called *magic cookies*.

Cookies are meant to be invisible. You're supposed to traipse all over the Web collecting these things without ever knowing about them. This isn't to say that cookies are evil, secretive things, dying to find out everything about you, but rather that, for the most part, they're a means for Web developers to gather information without bothering users. The transfer of cookies takes place as part of the HTTP transaction process, and thus is no more obvious than an HTML file download. Even less so, in fact, because the status bar on your browser doesn't distinguish between the cookie portion and the rest of a requested HTML document. Nor does the cookie appear when you use the View Source feature of your browser.

The whole point about cookies is that they provide a way for a stateless protocol, HTTP, to retain state information. In a stateless protocol, transactions are unrelated. In the particular case of HTTP, a browser makes a connection and sends a request, and a server responds by sending a file. The connection is then closed, and the server forgets all about it. A "stateful" version of HTTP would allow the server to recall some details of previous requests from that particular browser.

Think of dining out at a restaurant. Your visit would be "stateless" when you order, eat, and leave the restaurant, with no notice of your preferences taken by the manager or your waiter. Visit a good restaurant several times, however, and the manager or waiter

will remember your preferences and serve you accordingly. In such a case, you might say your visits have become "stateful."

If you want to see cookies in action, you need only configure your browser to tell you when you're about to receive one. Netscape Navigator and Microsoft Internet Explorer both offer options that notify you when a site is attempting to send you a cookie, and give you the option of refusing the cookie. In Navigator, you'll find the option on the Protocols tab in the Options | Network Preferences menu item; in Internet Explorer, click on the Advanced tab in Options. Bear in mind, though, that a great many sites use cookies these days, and some use more than one. SpryNet's home page (www.sprynet.com), for instance, hits you with four cookies the minute it loads. With cookie notification turned on, therefore, your Web browsing will be interrupted repeatedly. But it's worth trying for even a few hours to get a sense of the growing scope of cookie use.

HOW DO COOKIES WORK?

Cookies are made possible by the fact that an HTTP transaction involves a request and a response. The Web client software—your browser—sends a request to a server, and the server issues a response, in which it returns a document to the client.

Cookies are exchanged between server and browser through the HTTP headers Set-Cookie, from the server, and Cookie, from the browser. We'll deal with only the Set-Cookie header here, since the Cookie header essentially repeats the same information.

The Set-Cookie header is in the following format:

```
Set-Cookie: Name=Value;
Expires=DateTime; Path=DirectoryPath;
Domain=DomainName; Secure
```

The components of the Set-Cookie header are shown in the table on the left.

Here's an example of how to use these components. Let's say you're the Webmaster for Acme Corp. and you're using a cookie to save user preferences for your site. Only users who visit the server neatstuff.acme.com will be served cookies, rather than all visitors

HTTP COOKIE KEYWORDS

Keyword	Use
Set-Cookie	The HTTP header line
Name/Value	The name of the item you want to store, plus the value for that name.
Expires/DateTime	The expiration date and time for the cookie. The default is the end of the current session
Domain/DomainName	The domain name, either specific (www.company.com) or in a wildcard format that includes all subdomains (*.company.com). The domain name value must include at least two periods, to prevent a blanket domain such as .com from being used
Path/DirectoryPath	The subdirectory the browser must request if the server is to send a cookie back to the browser. The default is Path=/, which means a cookie will be served to all browsers visiting the URL. To specify a subdirectory, use the syntax Path=/<subdirectory>. The path is checked only if the domain has already been validated
Secure	A notification that the cookie is to be sent only via a Secure Sockets Layer (SSL) connection, via the HTTPS command

to *acme.com*. The information will be stored in the default subdirectory (/), and the cookie is set to expire at the end of the century. Your Set-Cookie header might look something like this:

```
Set-Cookie: username=73937;
expires=Friday, 31-Dec-1999 23:59:59
EST; path=/UserPrefs;
domain=neatstuff.acme.com
```

You could write the cookie into an HTML file by placing it inside the HEAD container,

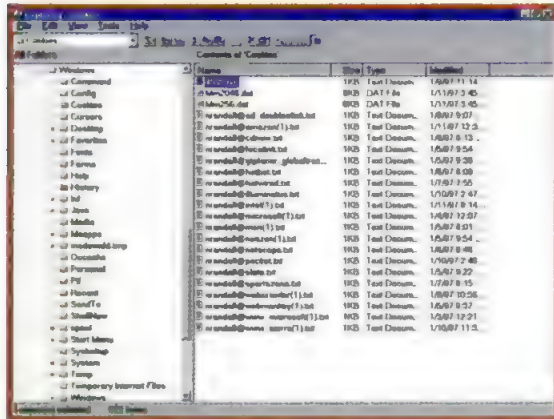


FIGURE 1: This Explorer view shows the contents of the folder containing cookies for use with Microsoft Internet Explorer.

specifically inside a META tag with the HTTP-EQUIV attribute.

```
<HEAD><META HTTP-EQUIV="Set-Cookie"
CONTENT="username=73937;
expires=Friday, 31-Dec-99; 23:59:59
EST"; path=/;
domain=neatstuff.acme.com></HEAD>
```

To continue the example, the next time a user visits your site, his browser will check the cookies directory or file on his hard disk against the *neatstuff.acme.com* domain name. Since a default path is used, path checking isn't relevant, so the browser will send the following header:

```
Cookie: username=73937
```

It's a very simple example, but you can easily see how cookie-furnished information can grow. A user could stay in your site and request a form for setting preferences. He could choose a yellow background, for example, and the server would return the following cookie:

```
Set-Cookie: Background=yellow
```

The next time the user visits, the browser will send the cookie information:

```
Cookie: username=73937;
Background=yellow
```

In this way, a detailed preferences file can be built for any user.

COOKIE STORAGE

Cookies work primarily because they're stored on your hard disk. Where exactly? Various places, actually, depending on which browser you were using when a cookie was served. Cookies retrieved through Internet Explorer are saved in *c:\windows*

cookies, a sample of which is shown in Figure 1. If you're using Netscape Navigator, on the other hand, the cookies are stored in a single text file called *cookies.txt* in the browser's program folder, usually *c:\program files\netscape* navigator. With Netscape Communicator, cookies are divided by users, with each user's *cookies.txt* file appearing in his or her subdirectory inside the Users folder. That gives Communicator an advantage for a computer with more than one user, because

users' cookies are segregated.

Figure 2 shows a sample Netscape Navigator *cookies.txt* file after a minimal amount of surfing. Every time a server sends a cookie to this user through Navigator, a new line corresponding to the server's domain name is added to the *cookies.txt* file, and the specific information is included with it.

```
# Netscape HTTP Cookie File
# This is a generated file! Do not edit.

.amazon.com      TRUE /          FALSE 855388800
.amazon.com      TRUE /          FALSE 855388800
www.cdnow.com    FALSE /         FALSE 942189160
.hotbot.com      TRUE /          FALSE 937396800
```

FIGURE 2: Here is an example of a Netscape Navigator cookie file.

If you visit *vineyard.net/cgi-bin/slg/cookie*, a cookie is used to save your user preferences. As you can see in the screenshot shown in Figure 3, the page first appears with the standard silver background, black text, and default font size, but choosing options from the form and then clicking Set Preferences requests the updated page and a cookie specifying your chosen preferences. The same figure shows how Netscape alerts you to the cookie, including the preference details and the date the cookie expires. Accepting the cookie means that when you return to the

page, your first name and chosen appearance settings will be remembered. It also means that a new line is added to the *cookies.txt* file. In this case, the line is

```
vineyard.net FALSE/FALSE
855630590 preferences
&&background&teal&name&Neil&size&3&
text&black
```

COOKIE LIMITATIONS

You might be wondering by now if every page you've ever visited has placed huge gobs of cookies on your hard drive. You can easily check, of course, by visiting the cookie folder for Internet Explorer or the *cookies.txt* file for Navigator. The cookie specification sets limits on cookie details that can be assigned to a user's browser. Your cookie files can contain no more than 300 cookies in total—and no more than 20 for a specific domain name. Once the total limit is reached, cookies are automatically deleted from the file, oldest first. In addition, each cookie can consist of no more than 4,096 characters. Extra characters are simply lopped off.

COOKIE USES

To date, cookies have been used primarily for retaining online ordering information, tracking site navigation, and personalizing Web pages.

Ordering Systems: Sites that offer you a shopping basket to work with, including the Bookstacks Unlimited site (*www.books.com*) and the Netscape General Store (*merchant.netscape.com/netstore*), use cookies to retain information about what you've put into your basket. Cookies, in fact, are the reason you can put some items into your shopping basket

```
session-id-time 852604702
session-id      9226-4116301-440591
cookTrack       111276159-852605358
ink             IU0EweErE427344E134
                D6315F51CBF8A4ACE02D3
```

and end your online session—and then see your basket exactly as you left it when you return to the site. Click on the Buy button for any item that you would like to purchase from Netscape's store, for instance, and you'll be asked if you'll allow a cookie to be set. In fact, your session will generate multiple cookies. Then, even if you shut down the browser, your shopping basket will be intact the next time you visit the store.

Personalizing Web Sites: The site mentioned above, *vineyard.net*, is one example of the use of cookies to personalize Web pages, but

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Neil Randall is author of *The Soul of the Internet*, published by International Thompson Computer Press, and a frequent contributor to PC Magazine.



PC Tech/Utilities

By Gregory A. Wolking

Printing the Screen in Windows 95

PrintNow makes the PrtSc key work just as it did under DOS.

Remember the good old days, when all you had to do to dump your screen to your printer was press the PrtSc key? I do, and it's one of the features I sorely miss now that I'm using Windows 95. You can still get screen dumps from text-mode DOS applications using Shift-PrtSc, but there's no equivalent function for Windows applications.

Windows uses the PrtSc key to capture an image of the entire desktop and Alt-PrtSc to capture an image of the active window, but neither of those functions prints anything; they just place a copy of the image in the Clipboard. The only way to get hard copy is to paste the image into a graphics application and print it from there. I wrote PrintNow to eliminate the extra steps.

PrintNow runs in the background, waiting for you to press PrtSc or Alt-PrtSc. When you do, it presents a standard Print dialog, so that you can select the desired printer settings, and then prints the image you just captured. You can also use PrintNow manually to print almost any device-independent bitmap (DIB) image you place in the Clipboard.

Though it was written for the Windows 95 environment, most of PrintNow's features work under Windows NT 4.0 as well. Under Windows NT, PrintNow will correctly print and scale bitmaps from the Clipboard. Because of differences in the implementation of certain API functions, however, PrintNow cannot detect when a user has pressed PrtSc or Alt-PrtSc. So if you run PrintNow under Windows NT 4.0, you will have to use PrintNow's menu or dialog box to print the Clipboard image after pressing PrtSc or Alt-PrtSc.

You can obtain a copy of PrintNow by downloading it from PC Magazine Online or by mail. (Refer to the sidebar "Getting the Files" for details.) The source code for PrintNow, which was written in Microsoft Visual

C++, is also provided for those interested in seeing how it works.

USING PRINTNOW

To install the program, place the program files Printnow.exe, Printnow.hlp, and Printnow.cnt in a directory of your choice, then create a shortcut to Printnow.exe. PrintNow does not write to an .INI file or to the Windows Registry. You may wonder, then, where PrintNow stores your preferences. The answer is that it doesn't. As you'll see, PrintNow's multiple-instance feature makes saving preferences undesirable. But you can use command-line

and commands as the menu, so you can use whichever interface you prefer. If the dialog is already open, click either mouse button on the tray icon to bring it to the foreground.

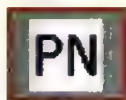
The dialog works much like a property sheet. If you change a setting, it does not take effect until you click either the Apply or the OK button. The Apply button leaves the dialog open, and the OK button hides it. Clicking the Cancel button hides the dialog and discards your changes, except for printer settings; the Print dialogs have their own OK and Cancel buttons. To get pop-up help for any of the dialog's controls, point at the control, click the right mouse button, and select What's This? from the context menu. To get full help, click the Help button or press F1.

Conversely, when you use the tray icon's pop-up menu to change a setting, the new setting takes effect immediately and the menu reopens automatically, so that you can see the change. Technically, this is nonstandard behavior, but I find it annoying for pop-up menus with multiple check-box or radio-button items to close immediately after you change a setting. Otherwise, the menu's behavior is standard. To close it, select Close Menu, click anywhere outside the menu, or press the Esc key.

IN THIS ISSUE

PrintNow

PrintNow is a 32-bit application that runs only under Windows 95. It lets you use PrtSc and Alt-PrtSc to send a screen capture directly to your printer, instead of just copying the image to the Windows Clipboard.



switches (refer to the program's help for details) to launch PrintNow using settings other than the defaults. To remove the program, you need only delete its files from your disk.

When you launch PrintNow, the program adds its icon to the system tray. Point at the tray icon and the ToolTip will indicate the program's current status. Right-click on the icon to open the pop-up menu (see Figure 1). Double-click on the icon to activate the main dialog (see Figure 2). The dialog contains the same settings

PRINTNOW SETTINGS

You control PrintNow's behavior using check boxes and radio buttons or their pop-up-menu equivalents. The Screen Capture Enabled check box determines whether PrintNow activates automatically when you press PrtSc. By unchecking this box, you can disable PrintNow without removing it from memory.

The Always Show Print Dialog check box determines whether PrintNow presents a standard Print dialog box before printing each image, so you can change your printer settings

FOR PROGRAMMERS ONLY PrintNow is a Windows 95 application written with Microsoft Visual C++ 4.0 and MFC (Microsoft Foundation Classes). The full source code for PrintNow is available on PC Magazine's Web site and demonstrates these programming techniques:

- hooking the clipboard viewer chain to get notification of changes to the Clipboard's contents;
- tracking multiple instances of the same program; and
- using pop-up menus whose parent windows are hidden.

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or cancel the operation. When the box is cleared, PrintNow prints each image using the current printer settings.

The Center Image check box determines whether PrintNow will center the image on the page. When the box is cleared, the program prints the image flush at the top left corner of the page.

The Image Scaling radio buttons let you control image scaling. The options Full, $\frac{3}{4}$ Page, and $\frac{1}{2}$ Page scale the image to fill the specified portion of the total page area while maintaining the image's aspect ratio. The No Scaling option does not scale the image unless it is larger than the page. In that case, PrintNow shrinks the image as necessary, without attempting to maintain its aspect ratio. If the image is too wide for the page, the program shrinks the width to fit. If the image is too tall for the page, the program shrinks the height to fit. With most printers, this option produces a very tiny printout, because each pixel in the image maps directly to one pixel (or less) on the page. For example, on a printer that prints 300 dots per inch (dpi), an 800-by-600 screen with no scaling will be rendered 2 inches high and under 3 inches wide.

PRINTNOW COMMANDS

To print a copy of the image currently stored in the Clipboard, select Print Clipboard Image. Any image in DIB format, regardless of its source, will be printed; for example, you might select a rectangular area in Paint and copy it to the Clipboard. The Print Clipboard Image item is disabled if the Clipboard does not contain a DIB image when you open the menu or launch the dialog. The Clipboard's contents may change while the dialog or menu is open. If the Screen Capture option is enabled, the dialog's command button will track the Clipboard's contents dynamically, but the pop-up menu cannot do this. If the Clipboard's contents are no longer in the proper format by the time you issue the command, PrintNow presents an appropriate message and cancels the operation.

Select Print Setup to launch a standard Print Setup dialog box and change your printer settings. This is particularly useful when you have disabled the Always Show Print Dialog setting.

The Unload PrintNow (*n*) command terminates the current instance (*n* represents the instance counter) of the program and removes its icon from the system tray; Unload All Instances does the same for all instances, including the current one. If any instances are printing when you issue this command, they will shut down immediately after they have finished printing.

USING MULTIPLE INSTANCES

You may run more than one instance of PrintNow at a time. Each instance will maintain its

own settings and generate its own printout. Thus, you can send a screen dump to multiple printers or make multiple copies with different printer settings, all with a single keystroke. Each instance's tray icon will look the same, but you can identify which is which by the *instance counter*. You can see this number, displayed inside parentheses, in the tray icon's ToolTip, the pop-up menu's Open and Unload commands, and the main dialog's caption. The instance counter starts at 1, increases by 1 for each instance you launch, and does not reset until all instances are unloaded.

Multiple instances work most efficiently if you use the Print Setup command to select the desired printer and printing options, then disable the Always Show Print Dialog option. If you use multiple instances to print to the same printer, that printer's driver must have print spooling enabled. Each instance prints asynchronously, so the order in which the images print will usually have no relation to the instance counter.

While printing is in progress, each instance requires enough memory to hold its own separate copy of the image. If all you want to do is print multiple copies of an image on the same printer with the same settings, it's much more efficient to use the Copies field in the Print dialog than to launch a separate instance of PrintNow for each copy.

PRINTING TO A FILE

PrintNow can print to a file as well as to a physical printer. Just check the Print to File box in the Print dialog, or select a printer driver that's connected to the FILE: device. Windows will present a file selection dialog when printing begins. Using this function bypasses the print

printing, PrintNow changes the mouse pointer to a wait cursor. The system will appear to ignore any mouse and keyboard input, but it doesn't. It merely delays processing your input until printing finishes, then it performs all of your commands in rapid succession. To prevent the possibility of sending commands to the wrong window, you should avoid using the mouse buttons until printing has been completed.

WORKING WITH DOS APPLICATIONS

DOS applications fall into two general categories: text-mode and graphics-mode. For text-mode applications, Windows provides the Shift-PrtSc command to dump the screen directly to LPT1:, just as PrtSc alone does in DOS. This works whether the application is running full-screen or in a window. If the application is running full-screen, PrintNow will not react when you press PrtSc or Alt-PrtSc, because Windows places the data in the Clipboard as text, not as a DIB image. PrintNow can print only DIB images.

When a text-mode application running in a window is active, pressing Alt-PrtSc captures a DIB image of the entire window, and PrintNow will print it just as it would any other window. This provides a couple of advantages over the Shift-PrtSc command, which prints only plain text in your printer's current font on an otherwise blank page.

- You get an accurate rendition of the entire window, including its frame and caption, as it appears on the screen—in color, with a color printer, or otherwise in gray-scale. For example, programs that display white text on a black background (the default DOS colors) will print as white text on a black background,

not black text on a plain page.

- Your printer won't go nuts if the display contains characters that your printer would interpret as control codes instead of as literal text.

- You won't have to eject the page manually when the screen dump is finished.

The sole drawback is that with a monochrome printer, some color combinations don't reproduce very well.

For graphics-mode applications running full-screen, PrtSc and Alt-PrtSc perform the same function. They capture the entire screen, if possible, and place it in the Clipboard as a DIB image. The key phrase is *if possible*; many such applications use the dis-

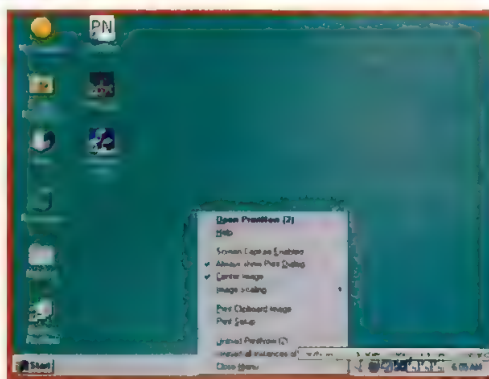


FIGURE 1: You can run multiple instances of PrintNow configured for different purposes. This is useful when you have more than one printer. Shown here is the pop-up menu for the second instance.

The most important consideration is that some printer drivers are horribly slow when printing to a file. Therefore, you should not use this option while any timing-sensitive applications, such as communications software, are running. You must also be patient. While

play adapter in a way that prevents Windows from capturing the screen. If Windows can't capture the image, it will present an error message telling you that the program's display mode doesn't allow capture, and of course there will be nothing for PrintNow to print.

Even if Windows can capture the image, PrintNow will not activate automatically when you press **PrtSc**. Some DOS applications misbehave when Windows suspends

• `ChangeClipboardChain()` removes a window from the chain.

Once a window is added to the chain, it receives `WM_DRAWCLIPBOARD` messages when the Clipboard's contents change and `WM_CHANGECHAIN` messages when a viewer other than itself is removed from the chain. For the viewer chain to work properly, each viewer must provide handlers for these messages. In addition to any processing of their own, they must pass these messages along to the next viewer in the chain, when appropriate. Finally, you must remove your viewer from the chain before you destroy it.

You need to take special care when calling `SetClipboardViewer()`. You must save the handle it returns and use that handle to pass any `WM_DRAWCLIPBOARD` or `WM_CHANGECHAIN` messages down the chain when appropriate. You cannot rely on a NULL return value from `SetClipboardViewer()` to indicate an error condition. The function *does* return NULL if it fails, but it also returns NULL if the chain is empty. Therefore, you must call `GetLastError()` immediately after calling `SetClipboardViewer()`. `GetLastError()` returns a `DWORD`. If bit 31 of that `DWORD` is set, `SetClipboardViewer()` failed. In Visual C++, you can use the `SUCCEEDED()` macro to test this return value.

It is critical to note that if `SetClipboardViewer()` succeeds, the system uses `SendMessage()` to send a `WM_DRAWCLIPBOARD` message to your window before `SetClipboardViewer()` returns. Since `SetClipboardViewer()` has not yet returned a "next viewer" handle, your window's `WM_DRAWCLIPBOARD` handler must not try to pass this first message down the chain. You should use a flag of some sort to prevent this, or the results can be unpredictable. This is the *only* time your viewer does not have to pass a `WM_DRAWCLIPBOARD` message down the chain.

It is possible to add a given window to the chain more than once. If you do this twice in direct succession, your window's "next viewer" handle will point to itself. As a result, when the system sends a `WM_DRAWCLIPBOARD` message to your window, it gets stuck in a loop sending the message to itself. This causes infinite recursion, which will eventually crash the application, and possibly the entire system. Therefore, it is vital to make sure that your window is not already hooked into the chain before calling `SetClipboardViewer()`.

When the Clipboard removes a viewer from the chain, it sends a `WM_CHANGECHAIN` message down the chain after removing the window. The message parameters provide two handles, of the window that was removed and the window that follows it. Each

remaining viewer must check to see if its "next viewer" handle points to the window that was removed. If not, it simply passes the message along to the next viewer. If so, it must replace the old handle with the new one.

I should point out that while debugging my `WM_CHANGECHAIN` handler, I discovered a nasty error in the documentation for the Microsoft Foundation Classes (MFC). MFC provides its own `ChangeClipboardChain()` function as a member of the `CWnd` class. The help topic for `CWnd::ChangeClipboardChain()` states that its return value (TRUE or FALSE) indicates success or failure, and I was depending on that for PrintNow's error checking. It took me a long time to figure out why PrintNow kept crashing if there were any other viewers in the chain when it tried to unhook itself. You'll find correct documentation for this function in the Windows API reference. Specifically, if there are other windows in the chain, the return value is *typically* FALSE, because that's what each window's `WM_CHANGECHAIN` handler should return when it processes the message. If your window is the only one in the chain, the return value is *typically* TRUE. But the key word is *typically*, because not all viewers necessarily respond this way—especially if they were written using MFC by someone depending on Microsoft's documentation! The correct way to verify whether `ChangeClipboardChain()` succeeded is to call `GetLastError()` immediately after `ChangeClipboardChain()`, then use the `SUCCEEDED()` macro to test the result.

When writing your window's `WM_DRAWCLIPBOARD` and `WM_CHANGECHAIN` handlers, it's important to realize that the system uses `SendMessage()` to send the message to the top of the chain, and each viewer must also use `SendMessage()` to pass them along. Unlike the related function `PostMessage()`, the `SendMessage()` function does not return until the receiving window has processed the message. That means the system waits for each viewer in the chain to process the message before execution continues. Therefore, you should design these handlers as efficiently as possible to avoid tying up the system for too long.

I wrote my `OnDrawClipboard()` handler as a series of simple tests to determine whether it should take action when it receives the message. I begin by checking a Boolean flag set by the `HookClipboard()` function. If this flag is set, I know that the message resulted from hooking into the chain, so I simply clear the flag and exit the handler. Next, I test the handle to the next viewer in the chain. If it's not NULL, I use `SendMessage()` to pass the message along and let any other viewers handle it before continuing with my own code.

When `SendMessage()` returns, I check a Boolean flag to see if the main dialog is active. If so, I use `PostMessage()` to place the

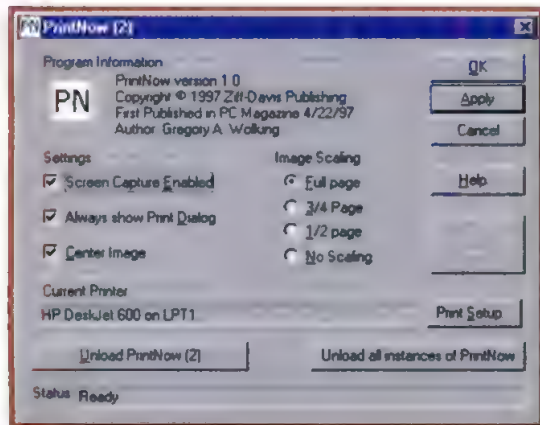


FIGURE 2: The main dialog for PrintNow contains the same options as the pop-up menu; you can use whichever interface you prefer.

them to switch to the desktop, so I left it to you to decide whether to switch away from a DOS application while it's still running. Once the image has been captured, it will remain in the Clipboard until you replace it with something else. You can use PrintNow's `Print Clipboard Image` command to print that image whether you shut the application down completely or just switch away from it temporarily.

INSIDE PRINTNOW

I wrote PrintNow using Microsoft Visual C++, Version 4.0. The program takes advantage of two Windows features. The first is the `SetClipboardViewer()` function, which takes an `HWND` and `Alt-PrtSc` place a copy of the image into the Clipboard as a DIB. Since I'm native to Windows, I can use the `SetClipboardViewer()` function to manipulate the clipboard. The second is a Windows mechanism called the `viewer chain`, which allows windows to hook themselves into the chain to receive notification messages when the Clipboard's contents change. I use this mechanism to implement PrintNow's `Print Clipboard Image` command.

THE VIEWER CHAIN

The `SetClipboardViewer()` function makes three API calls to construct the clipboard viewer chain: `GetClipboardViewer()` returns the handle of the current viewer in the chain.

`SetClipboardViewer()` adds a window to the chain and returns a handle to the new viewer.

WM_MY_UPDATE_BUTTON message into the main dialog's message queue and continue processing without waiting for the dialog to handle the message. This lets the dialog enable or disable the Print Clipboard Image command button appropriately when the Clipboard's contents change.

After checking another Boolean flag to make sure the program is not already busy printing an image, I call `IsClipboardFormatAvailable()` to see if the Clipboard contains a DIB image. If it does, I test the handle of the Clipboard owner to see if it is the Desktop window. If it is, I know that the image got there as a result of `PrtSc` or `Alt-PrtSc` (as opposed to being cut or copied to the Clipboard from another application), so I know that I should print the image. Once again, I use `PostMessage()` to place the WM_MY_PRINT_CLIPBOARD message into the dialog's message queue, then exit the handler. Therefore, printing does not begin until after `OnDrawClipboard()` has returned control to the system.

POP-UP-MENU PITFALLS

I had major problems with the tray icon's pop-up menu, which I launch using the `TrackPopupMenu()` API call. The menu would operate correctly as long as I selected a command from it, but it went nuts if I clicked outside its borders. Normally, doing so should close the menu, but it didn't. The menu would remain on the screen until I activated another window and then passed the mouse pointer back over the menu. After that, the menu would sometimes fail to launch, flickering briefly on the screen and occasionally locking the program entirely. The first workaround I found was to move the dialog completely off the screen, make it visible, launch the menu, then hide the dialog again after the menu closed. This worked, but it required a lot of extra code to keep track of the dialog's position when I wanted to display or

hide it under normal circumstances.

Fortunately, I got a tip from fellow Utilities column author John Deurbrouck. He pointed me to an article (Q135788) in the Microsoft Knowledge Base. In short, the article says that in order for `TrackPopupMenu()` to work properly when the menu's parent window is hidden, you must call `SetForegroundWindow()` to make the parent window active before calling `TrackPopupMenu()`. When `TrackPopupMenu()` returns, you must post a dummy message (such as WM_NULL) to the parent window to force it to switch back out of menu mode. Ironically, the MSKB article states that this problem is by design!

TRACKING MULTIPLE INSTANCES

The ability to run multiple instances of `PrintNow` can be very useful, but I had to find a way for a user to tell which instance of the program is active at any given time. I decided to use a simple counter and place it in the main dialog's caption, the menu's Open and Unload command captions, and the tray icon's ToolTip text. To provide easy access to this counter, I use a named file-mapping object. Using a named object allows each instance to find the shared data without having to communicate directly with the others.

When `PrintNow` starts, the `InitInstance` function calls `OpenFileMapping()` to open a memory-mapped object named `PrintNow Data`. If the call fails, I know the object doesn't exist yet, so no other instance is running. If so, I use `CreateFileMapping()` to create a new object. I specify `0xFFFFFFFF` as the function's first parameter to tell the system to create the object in the system page file, name the object `PrintNow Data`, and make it just large enough to hold a `UINT` (though of course an entire 4,096-byte page is allocated).

Once I've obtained a handle to the file-mapping object, I call `MapViewOfFile()` to tell the system how I will access its contents.

This function returns a pointer to the first byte of the specified region of the object. Since I'm using a single `UINT` for my counter, I cast the return value as a `UINT *` and store it for later use. Once I have the counter's address, I set its value to 1 if it's the first instance or increment it.

Using file-mapped data normally requires some type of synchronization mechanism, such as a `Mutex`, to keep two or more instances of an application from trying to modify the same piece of data at the same time. In `PrintNow`, I access the mapped data only once, during initialization, so that is not a problem. All I have to worry about is cleaning up when the program terminates, so my `ExitInstance()` function calls `UnmapViewOfFile()` to release my view of the object, then closes the object's handle.

Once all views of a mapped file object have been released, the system automatically destroys the object. If I were using a temporary file to map the data instead of the system page file, I would also have to provide a way to determine when the last instance terminates, so I would know whether to delete the temporary file. Using the system page file solves this problem neatly and eliminates any artifacts, such as undeleted .TMP files that could be left behind if an instance terminates abnormally.

The program's complete source code is available online for your perusal. It's thoroughly commented, so you shouldn't have any problems following it. `PrintNow` brings a handy feature from the DOS world to Windows, and it also demonstrates some useful programming techniques. □

Gregory A. Wolking is the primary sysop of the ZNET:TIPS Forum on ZDNet/CompuServe and moderator of the PC Magazine Utilities discussion area on the Web (www.pcmag.com/discuss.htm).

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Changing Windows 95's Name

Sometimes it's fun to change the name of your operating system. To change Windows 95's name (the name that's displayed every time you click Help | About Windows 95), follow these steps: Start REGEDIT and navigate to HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion. Find in the right-hand pane the value named Version and right-click to modify it. Change "Windows 95" to something you want (I chose "Doors 2000"). Now when you click Help | About Windows 95 in Explorer, Windows 95 has a new name.

KIEN TRAN
Ottawa, Ontario, Canada

just entered, it's very easy to check whether the string was too long.

Recovering a Missing Speaker Icon

Sometimes an application causes the speaker icon to disappear from the end of the Taskbar in Windows 95. To make it reappear, click on Start | Settings | Control Panel | Multimedia | Audio. In the box entitled Playback, click on the check box Show volume control on the Taskbar, then click OK. The speaker icon will reappear on your Taskbar.

MARC-ANDRÉ ROBERGE
Quebec, Canada

PC MAGAZINE: Quite a few readers have reported an inexplicable disappearance of the speaker icon. Fortunately, you can restore a lost speaker icon by digging into the Control Panel's multimedia applet, as explained above.

For those who like to know such things, the presence or absence of the speaker icon appears to be controlled by a single bit in the Registry. Specifically, the speaker icon appears if the 4 bit is set in an integer value named Services belonging to the Registry key HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Applets\SysTray. The data for this value is usually 3 (speaker icon absent) or 7 (speaker icon present). Fortunately, however, there's no reason to tweak this value when Control Panel will do the job.

Extract Windows 95 System Files Using a Batch File

Here's a fast way to extract a file from the Windows 95 .CAB files on the CD-ROM. Just copy the simple EXTRACAB.BAT file shown in Figure 2 to a directory on your path. If you are an old-fashioned DOS user, you can use it from

HIGHLIGHTS



HARDWARE The drawbacks and alternatives to adding a second disk as a live backup for your main hard disk. Page 228



OPERATING ENVIRONMENTS The Add/Remove programs list in Windows 95 can get cluttered pretty quickly; here's how to clean up the mess. Page 228



DATABASES There are several ways to disable Access's AutoExec Bypass keys depending on which version of Access you're using. Page 230

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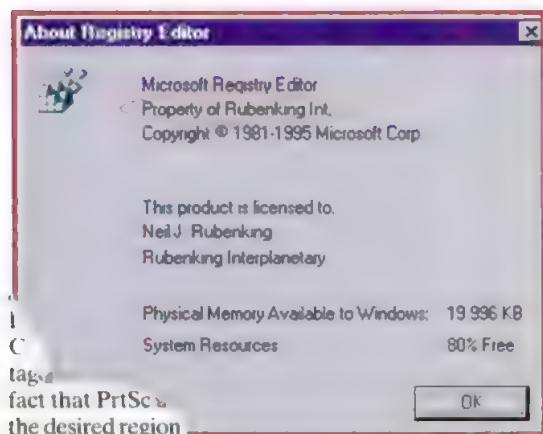
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Since DIB format is the Registry using REGEDIT, you use Windows API functions displayed on the second text line of image. The second if (About box (circled in red).

called the Clipboard Windows 95 to Doors earthshaking achievements have more practical whenever the Clipboard. An application that is changed to "Proper-

DESIGNING A CLIPBOARD

Clipboard viewers use the first window in the beginning of the chain. Note too that the he figure is for REG- changing the Version about box in every Win- is a limit to how much Version string. For ex- Rubenking Interplane- since REGEDIT's re string you've the next viewer in the chain.



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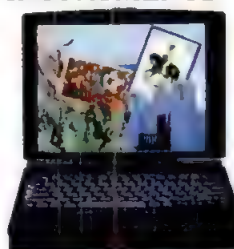
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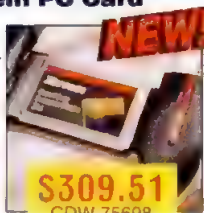
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```
@echo off
if "%1"==" " goto error
if "%2"==" " %0 %1 .
:: Change D:\WIN95 in the line below to the location
:: of the Windows 95 .CAB files on *your* system.
for %%1 in ( D:\WIN95\*.CAB ) do extract %%1 %1 /L %2
ECHO.
IF EXIST %2\%%1 ECHO %1 successfully extracted
IF NOT EXIST %2\%%1 ECHO %1 not found
goto end
:error
echo.
echo Syntax: EXTRACAB file-to-extract
echo          or EXTRACAB file-to-extract destination-directory
echo.
echo Example: EXTRACAB EXPLORER.EXE
echo          or EXTRACAB EXPLORER.EXE C:\TEMP
echo.
:end
```



FIGURE 2: Once you modify it to reflect the location of the Windows 95 setup .CAB files on your own system, this batch file will quickly extract any needed file.

the command line, but if you love shortcuts, you can make one using a question mark as a parameter for the batch file. Then when you double-click on it, a dialog box asking for parameters should appear. The batch file has two parameters; the first is the file to extract (you should provide the full name without the path) and the second is the directory in which the Windows 95 .CAB files reside.

MARCELO POLI
San Nicolas, Argentina

PC MAGAZINE: The EXTRACT program can very quickly determine whether a given .CAB file actually contains the file you're requesting. In fact, it's faster and easier to let EXTRACAB.BAT attempt to extract the desired file from every .CAB file than it would be to determine in advance which .CAB file to use. The only disadvantage is that the many repetitions of the EXTRACT program's copyright notice fill the screen and scroll off, taking with them any information about successful file extraction. I modified the reader's original batch file to report whether it successfully extracted the file.

I also hard-coded the location of the .CAB files, since this location is constant for a given computer system. Initially, you will have to change D:\WIN95 to the directory that contains the .CAB files on your particular system, but thereafter you need only to pass EXTRACAB.BAT the name of the file you want to extract. Optionally, the EXTRACT program can place the extracted file in a specific directory, using the /L switch. The modified version of EXTRACAB.BAT takes as its optional second parameter a destination directory. If this parameter is omitted, it uses the current directory. (You can download this batch file from PC Magazine Online.)

Remove Unwanted Icons from Your Desktop

It's not easy to remove certain icons from the Windows 95 desktop. Icons such as those for Inbox, Internet Explorer, and Recycle Bin are intended to stay there whether you like it or not. Removing them is easy if you have PowerToys, but even if you don't, you can remove them in the following way:

Open RegEdit and go to HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\explorer\Desktop\NameSpace. For every special icon, you will see a strange-looking key name, such as these:

```
{89292102-4755-11cf-9DC2-00AA006C2B84}
(Internet Mail)
{00020D75-0000-0000-C000-000000000046}
(Inbox)
{645FF040-5081-101B-9F08-00AA006C2B84}
(Recycle Bin)
```

If you delete any of these entries and reboot your system, the icon will disappear. To get it back, you just open RegEdit, type the key name, and reboot again.

WALTER STWORA
Mississauga, Canada

PC MAGAZINE: Frequent readers of this column will be familiar with PowerToys, a set of utilities written by the Microsoft Windows 95 development team and provided to users without cost (but also without support). You can download the latest version of PowerToys from www.microsoft.com. Some users don't have Internet access, however, and others

may not want to download and install the entire utility set for the sole purpose of cleaning up the desktop.

The sets of 32-digit numbers in curly braces are Globally Unique Identifiers, or GUIDs (pronounced *GOO-ids*). They identify objects that have been registered with the system; the list of GUID keys in the NameSpace won't necessarily be the same from computer to computer. If you plan to delete one of these keys, you must first store its original value somewhere secure, as you cannot safely copy the value from another system. Better yet, don't delete the key at all! Run RegEdit exactly as described above, but instead of deleting the key, right-click on it and select Rename from the context menu; then add a period at the start of the name and press Enter. When you restart the computer, the corresponding icon will be gone. If you want to restore it, just use RegEdit again to delete the period you added.

Accessing Frequently Used Folders

Like most PC users, I have several folders I need to access frequently. Many are subfolders more than one level deep (such as C:\Program Files\Netscape\Navigator\Download) that are tedious to navigate to via Explorer.

Here's my solution to speed up access to "buried" folders. In Explorer, click on your primary hard disk, then click on File | New | Folder and type in name, such as My Locations. Right-click the new folder and select Create Shortcut; press Ctrl-X to cut the new shortcut. Then paste the shortcut into your StartUp folder. Now you have a folder that will be opened each time you start Windows. Create a shortcut to each of your frequently used folders and paste the shortcuts into My Locations. Now a single Taskbar click on My Locations will bring up the folder with shortcuts to all of your frequently used folders.

JIM MIHALSKI
Allentown, Pennsylvania

PC MAGAZINE: For even easier access to your My Locations folder, right-click the desktop, choose New, and create the folder right there. That's what I do myself. I still have a StartUp shortcut that opens my special folder when Windows starts, but if I accidentally close it, I can just double-click its desktop icon.

This technique is by no means restricted to folders. You can also place shortcuts to your most frequently used programs and documents in the My Locations file. In fact, some users have been known to simulate the look of the Windows 3.x Program Manager by creating a number of different folders on the desktop to store groups of related program shortcuts.

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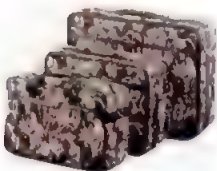


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Since I switched to Windows 95, the sound quality on some of my files has become terrible, as if they were being played on a worn-out record player and not on a high-tech digital system. I'm using a Media Vision Pro Audio Spectrum 16 that still works fine under DOS and Windows 3.1 (I use dual boot), but the sound is lousy under Windows 95. Is there anything I can do?

TAMIN B. SAWAF
Houston, Texas

PC MAGAZINE: In most cases, scratchy sound files under Windows 95 are caused by a problem with DMA assignments.

The first step is to make sure that Windows 95 is using the same assignments as the board's configuration. The easiest way to do this is to open the System applet in Control Panel, and in the Device Manager window, double-click on the Sound, Video And Game Controllers item, highlight the sound card, and then choose Remove. Restart your computer, go back to Control Panel, and choose Add New Hardware. Let Windows 95 auto-detect the sound card and configure the driver. Check the driver's properties using the Device Manager screen in the Control Panel's System applet to make sure no conflicts exist: Select your device, press the Properties button, and check the conflicting devices list at the bottom of the Resources page.

Another possible reason for your problem is that some cards do not work properly with a 16-bit DMA channel, especially for compressed sound files. In this case, see if you can reassign the "high DMA" setting (5, 6, or 7) to the same channel as the "low DMA" setting (1, 2, or 3).

Finally, some motherboards automatically assign DMA 1 to an on-board ECP (extended capabilities port) parallel port, which may conflict with your sound card's DMA assignment. Try reconfiguring the sound card to use a different DMA channel.—*Alfred Poor*

Mirror Image

Now that hard disks are so cheap, is it possible to have data copied or written simultaneously to a second drive? Would this require special software or a new HDD controller?

ANDREW HART
via the Internet

PC MAGAZINE: It certainly makes good sense to add a second disk as a live backup for your main hard disk. You can do this in a number of

different ways, but you should consider some drawbacks and alternatives first.

Disk-mirroring products, which provide fail-safe data storage, have long been an important part of local area network (LAN) design, but some products are suitable for single-station use as well. The most common approach is through hardware, using either a single controller to mirror the data on two hard disks or two separate controllers to maintain parallel images on separate disks.

At least one company offers a software solution to the problem. Octopus Technologies, of Yardley, PA (800-919-1009; 215-321-8750; www.octopustech.com), publishes WinStation for Windows 95 (\$49 list price). This product is designed to mirror disk contents between a workstation and a server on a LAN or between two workstations, but it can also be used to mirror the contents of a disk in a standalone system. According to a company representative, the product adds little overhead to normal system-processing demands.

You can also approximate the effect of a disk-mirroring product through the use of a file-transfer program. Most current versions of such programs have synchronizing features, which are designed to make sure that you have the same data on two separate systems—such as a notebook and a desktop system. The same feature can be used to copy the changes in the contents of one disk to another in the same system.

Disk-mirroring is convenient and can provide excellent protection against a hard-disk failure, but it still cannot replace the need for regular system backups. The reason is that if a file gets corrupted or damaged, the same damaged data will be written to both disks. Only a separate backup provides a clean copy of the undamaged data.—*Alfred Poor*

OPERATING ENVIRONMENTS

Cleaning up the Add/Remove Programs List



I'd like to know how to remove entries from the Add/Remove programs list. For example, I now have three entries for Netscape—one for each upgrade. Is there a way to clean up the list?

MICHAEL CIPRIANI
via ZD Net

PC MAGAZINE: The Add/Remove programs list is handy, but it can get messy rather quickly. When you delete a program using Windows Explorer, its line in the Add/Remove

programs list remains behind. If you use an uninstaller other than Windows 95's own, it will almost certainly leave behind the entry in the Add/Remove programs list. And in many cases, installing an update will put a duplicate line in the list. Almost every Windows 95 user will have some entries in the Add/Remove programs list that no longer correspond to existing applications.

To clean up the list, you'll have to use the Registry Editor. Launch REGEDIT.EXE from the Start menu's Run command and navigate to the key HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Uninstall. When you open the Uninstall key, you'll see a number of keys below it, one for each item in the uninstall list. Before doing anything else, choose Export Registry from the Registry menu and save this branch of the Registry tree to a file. Now, if you accidentally delete the wrong key you can roll back your changes by double-clicking the resulting .REG file. Carefully peruse the list of keys below Uninstall. When you find a duplicate, or a key corresponding to a program that no longer exists on the system, double-check it and then delete it.—*Neil J. Rubenking*

WORD PROCESSING

Using File Extensions In Word



When saving documents in Microsoft Word 6, I use the extension to help identify the document. For example, an extension of .DEC indicates documents written in December. When I choose the File | Open command, however, Word defaults to showing only those files with the extension .DOC, which means I have to go to the List Files of Type box and change the entry to All Files (.*). Is there any way to change the default so that I can avoid this minor chore every time I start Word?*

KEN LEGHORN
Sarasota, Florida

PC MAGAZINE: Starting with Word 7.0, with its support for long filenames, there isn't as much need to use file extensions to help identify document contents. Rather than using, say, .MEM for memos, .LET for letters, and so forth, you can simply include phrases like "Memo to" or "Letter to" in the filename. Similarly, you can include the month or even the full date as part of the filename. You can even enter filenames like Stone.let in the Save As dialog box and let Word save them as Stone.let.doc.

If you're still using Word 6.x, however, or need to exchange files with people who are, you may be better off limiting yourself to the old constraints for filenames. And even if

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there's no reason to limit yourself to those constraints for your new files, you may have lots of old files around with various file extensions. Either way, the following macro will let you set the Open dialog box to see all files:

```
Dim FileAll As FileOpen
FileAll.Name = "*.*)"
On Error Goto ForgetIt
Dialog FileAll
FileOpen FileAll
ForgetIt:
```

The macro will work in Word 6.x and Word 7.x but not in Word 8.x.

The first line in the macro creates what amounts to a copy of the FileOpen dialog box, and names it FileAll. The second line sets *.*) as the format of filenames to search for. The Dialog line opens FileAll as a dialog box. The

**If you're using
Word 7.x, there's a
little-known trick to
saving files with an
extension other
than .DOC.**

On Error line tells the macro to skip to the label ForgetIt if there's an error. Without it, you'll get an error message if you choose Cancel instead of OK to close the dialog box. The Dialog line actually opens the dialog box, and the FileOpen line, which comes into play after you click on OK, opens whatever file you chose in the dialog box.

To create this macro, choose Tool | Macro; enter FileOpen as the name for the macro, so that it will effectively replace the built-in FileOpen command; and choose Create. Then type in the macro text between the Sub MAIN and End Sub statements. Close the macro window, and choose File | Save All to save the macro to disk. Once you've created the macro, Word will run it whenever you summon the Open dialog box, whether from the File menu, the Open toolbar button, or the Ctrl-O shortcut key.

Note that if you're using Word 7.x, there's a trick to saving files with an extension other than .DOC. When you enter the filename, put it in quotes. Entering the name as Stone.let will name the file Stone.let.doc. Entering "Stone.let" will name the file Stone.let.

Be aware also that the macro printed here will not let you open multiple files with a single command. There is a relatively simple way

to toggle the macro on and off with another macro, but, alas, there isn't room to explain it here. I'll save that for a later time if there is sufficient interest.—M. David Stone

SPREADSHEETS

How Many Business Days?



I need to calculate the turnaround time for a list of reports in Lotus 1-2-3, Release 5. That means subtracting a report's closing date, in cell A, from the receiving date, in cell B. This gives me the total number of days from the time the report was received till the time it is closed. Is there a way of setting up a formula or macro to exclude Saturdays and Sundays, to obtain a figure only for workdays?

ALAN TRAN
Toronto, Canada

PC MAGAZINE: You can use 1-2-3's @NETWORKDAYS function. For example, if your closing date is in A1 and your date received is in B1, then

@NETWORKDAYS(B1,A1)

returns the number of workdays between receiving and closing. By default, the program defines workdays as all days except Saturday and Sunday, but you can change that definition if you want. You can also have @NETWORKDAYS exclude holidays from calculations.

The function's full syntax is as follows:

@NETWORKDAYS(start-date,end-date,
[holidays-range],[weekends])

where [holidays-range] and [weekends] are optional arguments. The function returns an inclusive calculation. Thus, for example,

@NETWORKDAYS(@DATE(97,1,24),
@DATE(97,1,27))

returns 2, because January 24, 1997, is a Friday and January 27, 1997 is a Monday—both business days.

To exclude holidays, list them in a worksheet range as date values, and reference the range as @NETWORKDAYS' third argument. For example, to calculate the number of workdays in 1997, excluding a set of holidays listed in E1..E12, you could write:

@NETWORKDAYS(@DATE(1,1,97),
@DATE(12,31,97),E1..E12)

To change the default exclusion of only Saturdays and Sundays, add a fourth argument. Use 0 for Monday, 1 for Tuesday, and

so on through 6 for Sunday, and enclose each number between quotation marks. For example, to exclude Mondays, Tuesdays, and Saturdays, you would make your weekends argument "125".

Note that if you use a weekends argument, you must also use a holidays-range argument, even if you don't care about excluding holidays. You can't include the argument by simply adding a comma to the formula. For example,

@NETWORKDAYS(@DATE(1,1,97),
@DATE(12,31,97),,"12")

is not acceptable. If you want the weekends argument but not the holiday-range, point to a blank cell for holiday-range, like this:

@NETWORKDAYS(@DATE(1,1,97),
@DATE(12,31,97),E1,"12")

where E1 is blank.

Quattro Pro and Excel also have NETWORKDAYS functions. Quattro Pro's works exactly the same as 1-2-3's; Excel's works almost the same way, too, with a couple of differences. For example, Excel's holiday-range argument is really a holiday argument, because the program doesn't require you to use a range. (You can state the argument as an array, instead, but it's simpler just to put it on the worksheet.) The more significant difference between Excel's function and those of 1-2-3 and Quattro Pro is that Excel's NETWORKDAYS doesn't offer a weekends argument.

All three spreadsheets also include a related WORKDAY function, which calculates the date that falls a specified number of workdays after or prior to a date. To have 1-2-3 return the date that's ten workdays from today, for example, you could write

@WORKDAY(@TODAY,10)

The equivalent Excel formula would be

=WORKDAY(TODAY(),10)

Lotus 1-2-3 and Quattro Pro accept holiday-range and weekends arguments, which work exactly as they do in @NETWORKDAYS. Excel accepts a holidays but not a weekends argument.—Craig Stinson

DATABASES

Disabling Access's AutoExec Bypass Key



If you want to bypass a Microsoft Access AutoExec macro, you can do so simply by pressing the Shift key while opening the database. Do you know if

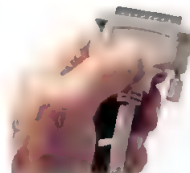


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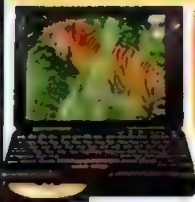
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420CDT	100MHz	11.3" Active	8MB/1.2GB	6X	\$2449
430CDT	120MHz	11.3" Active	16MB/1.2GB	10X	\$2699

Satellite Pro 420CDS
\$1679
3-Year TAP Warranty... \$99.97
5-Year TAP Warranty... \$299.97



Satellite Pro 420



Tecra 510

Tecra 500 & 510

- 120 & 133MHz processors
- Up to 10X CD-ROM drives on selected models
- 16MB EDO RAM memory
- 12.1" SuperVGA displays

Model	CPU	Screen	RAM/HD	CD Drive	Price
500CS	120MHz	12.1" Dual Scan	16MB/1.3GB	Opt.	\$1799
500CDT	120MHz	12.1" Active	16MB/1.3GB	6X	\$3449
510CDT	133MHz	12.1" Active	16MB/2.1GB	10X	\$4279

Tecra 500CS
\$1799
3-Year TAP Warranty... \$99.97
5-Year TAP Warranty... \$299.97

digital™



HiNote VP 500

Model	CPU	Screen	RAM/HD	CD Drive	Price
VP 560	133MHz	12.1" Dual Scan	16MB/1.4GB	12X	\$2449
VP 565	133MHz	12.1" Active	16MB/1.4GB	12X	\$3299
VP 575	166MHz MMX	12.1" Active	16MB/2.1GB	12X	\$4399

Product differs slightly from photo



Presario

HiNote VP 500

\$2449
3-Year TAP Warranty... \$229.97
5-Year TAP Warranty... \$349.97



HiNote VP 500

HiNote Ultra II

- Only 1.2" thick and 4.0 lbs!
- Up to 150MHz Pentium processors
- 11.3" SuperVGA Active Matrix displays
- 16MB of RAM memory

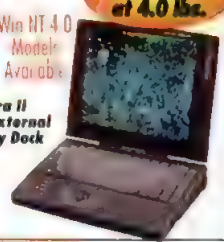
Model	CPU	Screen	RAM/HD	CD Drive	Price
Ultra II	133MHz	11.3" Active	16MB/1.35GB	Opt.	\$4499
Ultra II	150MHz	11.3" Active	16MB/1.44GB	Opt.	\$4799*
Ultra II	133MHz	11.3" Active	16MB/1.35GB	Opt.	\$4699**
Ultra II	150MHz	11.3" Active	16MB/1.44GB	Opt.	\$4799

* Features Win for Workgroups ** Features Win NT

HiNote Ultra II

\$4499
3-Year TAP Warranty... \$99.97
5-Year TAP Warranty... \$599.97

Win NT 4.0 Models Available



Ultra II with external Floppy Dock

COMPAQ

Presario Notebook

- 10X CD-ROM drive
- 128-bit PCI graphics
- Built-in 56K fax modem
- Integrated PremierSound audio
- MS Works, Quicken and more!

Model	CPU	Screen	RAM/HD	CD Drive	Price
1070	133MHz	12.1" Dual Scan	16MB/1.1GB	10X	\$2899
1080	166MHz MMX	12.1" Active	16MB/1.4GB	10X	\$4299

Presario 1070

\$2899
3-Year TAP Warranty... \$259.97
5-Year TAP Warranty... \$389.97

LTE 5000

Model	CPU	Screen	RAM/HD	CD Drive	Price
5250	120MHz	10.4" Active	16/810MB	Opt.	\$3099
5280	120MHz	11.3" Active	16MB/1.35GB	Opt.	\$3859
5300	133MHz	12.1" Active	16MB/1.35GB	Opt.	\$4349
5380	133MHz	12.1" Active	16MB/2.2GB	Opt.	\$4949
5400	150MHz	12.1" Active	32MB/2.2GB	Opt.	\$5139

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5-Year TAP Warranty... \$459.97



LTE 5000

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Hitachi E™

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- 11.8" Super VGA display
- Only 1.6" thick and 5.8 lbs.

Model	CPU	Screen	RAM/HD	CD	Price
E133T	133MHz	11.3" Active	16MB/1GB	8X	\$2199

E133T
\$2199
3-Year TAP Warranty...\$229.97
5-Year TAP Warranty...\$349.97



E Series
Notebook

Hitachi M™ & Mx™

- Integrated 10baseT Ethernet card
- Built-in cellular data fax modem
- 5 year warranty
- Up to SV CD-ROM drives

Model	CPU	Screen	RAM/HD	CD	Price
M1200	120MHz	12.1" Active	16MB/1.35GB	8X	\$1999
MX133T	133MHz	12.1" Active	16MB/1.35GB	8X	3999
MMX166T	166MHz	MMX 12.1" Active	16MB/2.1GB	8X	5199

M1200
\$1999
5-Year TAP Warranty...\$139.97



Mx Series
Notebook

NEC



13.3"
DISPLAY

Model	CPU	Screen	RAM/HD	CD	Price
6200MX	166MHz	MMX 13.3" Active	32MB/2.1GB	10X	\$6399
6050H	150MHz	MMX 12.1" Active	16MB/1.4GB	10X	\$4699
6050MX	150MHz	MMX 12.1" Active	16MB/2.1GB	10X	\$1999

Versa 6200MX
\$6399
3-Year TAP Warranty...\$99.97
5-Year TAP Warranty...\$799.97

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Versa 6200

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Ascentia A

Model	CPU	Screen	RAM/HD	CD	Price
A41	120MHz	11.3" Dual Scan	16MB/1.0GB	6X	\$1999
A42	120MHz	12.1" Active	16MB/1.0GB	6X	2499

Model	CPU	Screen	RAM/HD	CD	Price
J55	133MHz	11.3" Active	16MB/1.0GB Opt.		\$2249

Ascentia A41
\$1999
3-Year TAP Warranty...\$199.97
5-Year TAP Warranty...\$299.97

SHARP.

WideNote

Model	CPU	Screen	RAM/HD	CD	Price
W100D	133MHz	11.2" Wide Dual Scan	16MB/1.1GB	Opt.	\$2799
W100T	133MHz	11.2" SHA Wide Active	16MB/1.1GB	Opt.	3299

Model	CPU	Screen	RAM/HD	CD	Price
9300D	150MHz	12.1" Dual Scan	16MB/1.4GB	10X	\$2699
9300T	150MHz	11.3" Active "SHA"	16MB/1.4GB	10X	3199

Ask About Sharp's
Super-Light Zaurus PDAs

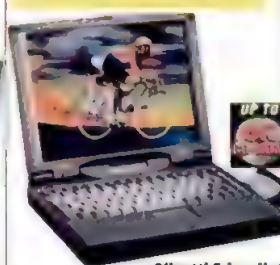
Sharp 9300

9300D
\$2699
3-Year TAP Warranty...\$99.97
5-Year TAP Warranty...\$399.97



olivetti

personal computers



Olivetti Echoes Notebook

Model	CPU	Screen	RAM/HD	CD	Price
Echos	100MHz	11.3" Dual Scan	8MB/1.3GB	6X	\$1624*
Echos	100MHz	10.4" Active	8MB/1.3GB	6X	1899*
Pro	133MHz	12.1" Dual Scan	16MB/1.3GB	8X	2999
Pro	133MHz	12.1" Active	16MB/2GB	8X	3499
Pro	150MHz	12.1" Active	16MB/2GB	8X	3999

* After instant rebate. Includes Docking station. Valid through 3/31/97

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STATION ON
SELECT MODELS

Echos
\$1624*
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5-Year TAP Warranty...\$229.97

hp **HEWLETT®**
PACKARD



HP OmniBook
800 Notebook PC

Model	CPU	Screen	RAM/HD	CD	Price
800CS	100MHz	10.0" Dual Scan	16/810MB	Opt.	\$2449
800CT	133MHz	10.4" Active	16MB/1.4GB	Opt.	3469

Model	CPU	Screen	RAM/HD	CD	Price
5500CTS	120MHz	10.4" Active	16MB/1.35GB	Opt.	\$2749
5500CTS	133MHz	12.1" Active	16MB/1.35GB	Opt.	3279
5500CTS	133MHz	12.1" Active	16MB/2GB	Opt.	3549

HP OmniBook 800CS

\$2449
3-Year TAP Warranty...\$99.97
5-Year TAP Warranty...\$349.97

Additional \$500
models available.
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TEXAS
INSTRUMENTS



Model	CPU	Screen	RAM/HD	CD	Price
6000	133MHz	12.1" Dual Scan	16MB/1.35GB	8X	\$3179
6000	133MHz	11.3" Dual Scan	16MB/1.35GB	8X	3949

Model	CPU	Screen	RAM/HD	CD	Price
6030	133MHz	12.1" Active	16MB/1.35GB	10X	\$3399
6050	150MHz	12.1" Active	16MB/1.35GB	10X	3699
6150	166MHz	12.1" Active	16MB/1.35GB	10X	4899

NEW MMX
MODELS

Extensa 6600DT
Product differs slightly from photo

Extensa 6600DT
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5-Year TAP Warranty...\$459.97

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- Tons of FREE software

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SOUND

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7130	133MHz	16MB/1.6GB	8X	\$1299
7160	166MHz	16MB/2.1GB	8X	1599
7161	166MHz MMX	32MB/2.4GB	12x	1899
7200	200MHz	16MB/3.0GB	8X	2199
7201	200MHz MMX	32MB/3.0GB	12x	2199

Infinia Monitors

Model	Size	View	Resolution	Price
Infinia	15"	13.78"	1280 x 1024	\$459
Infinia	17"	16.23"	1280 x 1024	759

InTouch™ Module.
Jump from CD to TV
to radio to answering
machine, each with
the touch of a button.

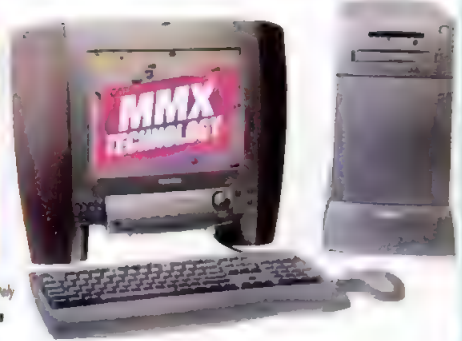
MMX 7130

\$1299

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5-Year TAP Warranty... \$229.97

Monitors priced separately

Toshiba Infinia
Multimedia



COMPAQ

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Presario Multimedia

- 16X CD-ROM drives
- 3D surround sound with IBM Prospeakers
- First of FREE Educational and business software
- 33.6 data fax modem
- Up to 8.5GB hard drives

Model	CPU	RAM/HD	CD	Price
4764	166MHz MMX	24MB/2.5GB	16X	\$1899
4770	200MHz MMX	32MB/3.8GB	16X	2299

Presario Monitors

Model	Size	View	Resolution	Price
Presario	14"	12.9"	1024 x 768	\$399
Presario	15"	13.5"	1024 x 768	479
Presario	17"	15.6"	1280 x 1024	749

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pentium®

**33.6 SPEED
DATA FAX
MODEM**

**16X
CD-ROM**

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Monitors priced separately

Compaq Presario Multimedia

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Aptiva Multimedia

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- Pentium MMX™ technology
- Integrated audio on optional monitor
- Vivid graphics with Total Image 3D™
- 3D stereo sound with Theater Sound™

Model	CPU	RAM/HD	CD	Price
CBE	166MHz MMX	32MB/3.2GB	16X	\$2149
C9E	200MHz MMX	32MB/3.2GB	16X	2299
S8C	166MHz MMX	32MB/3.2GB	16X	2399
S9C	200MHz MMX	32MB/4.2GB	16X	2599

Aptiva Monitors

Model	Size	View	Resolution	Price
MM50	15"	13.7"	1024 x 768	\$499
MM70	17"	15.7"	1024 x 768	799

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Aptiva CBE

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5-Year TAP Warranty... \$229.97

hp HEWLETT® PACKARD Pavilion

intel
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pentium®

**16X
CD-ROM**



HP Pavilion Multimedia

Pavilion Multimedia

- 16X CD-ROM drives
- Up to 200MHz MMX Pentium processors
- Up to 1 FREE CD-ROM titles
- 33.6 data fax modem with speaker phone
- 16MB or 32MB EDO RAM memory
- 3D stereo audio and graphics

Model	CPU	RAM/HD	CD	Price
7320	166MHz MMX	16MB/2.1GB	16X	\$1799
7360	200MHz MMX	32MB/3.8GB	16X	2299*

* Processor manufacturer's suggestion

Pavilion Monitors

Model	Size	View	Resolution	Price
Pavilion	15"	13.8"	1024 x 768	\$449
Pavilion	17"	15.7"	1024 x 768	749

Monitors priced separately

**100
Manufacturer's
MAXIMUM LISTED ON
MODEL 7360**

Pavilion 7360

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Advantage Adventure Multimedia

- Up to 200MHz MMX Pentium processors
- 1 p to 16X CD-ROM drives
- MPEG Level 1 playback support
- 1 p to 33.6 data fax voice modem
- 3-D graphics and sound
- Loads of FREE software

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Model	CPU	RAM	CD-ROM	Price
9402	166MHz MMX	32MB/2.0GB	16X	\$1799
9404	200MHz MMX	32MB/2.0GB	16X	2079
9406	200MHz MMX	64MB/4.0GB	16X	2599



Advantage 9402

\$1799

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NEC

Ready Multimedia

- Up to 200MHz processors with MMX technology
- 8X and 16X CD-ROM drives and audio wavetable
- 33.6 data fax modem
- 256KB cache memory
- 4MB standard video memory
- Tons of FREE software
- Up to 3.2GB hard drives



Model	CPU	RAM	CD-ROM	Price
9710	166MHz MMX	16MB/2.1GB	8X	\$1799
9712	166MHz MMX	32MB/3.2GB	16X	1999
9716	200MHz MMX	32MB/3.2GB	16X	2199

Monitors priced separately

Additional models available. Call for details.



NEC Ready Multimedia Product differs slightly from photo

Ready Multimedia

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Monitors priced separately

SONY

VAIO Multimedia

- Up to 200MHz Pentium processors
- Over 30 pre-installed software titles
- 28.8 fax modem with speaker phone allows simultaneous voice & data communications
- 16-bit wavetable stereo sound with optional speakers
- 3D accelerated graphics with MPEG support

Model	CPU	RAM	CD-ROM	Price
VAIO	200MHz MMX	32MB	3.8GB	\$1999
VAIO Monitor				2399

Model	Size	Resolution	Price
VAIO	15"	13.9"	1280 x 1024
			\$579

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Sony VAIO Multimedia

INTEVA Microsystems

AMD Processors

- Pentium 133MHz processor
- 8X CD-ROM drive
- Up to 33.6 speed fax modems
- Tons of FREE software

Model	CPU	RAM	CD-ROM	Price
AMD	133MHz	8/850MB	8X	\$999
AMD	133MHz	8MB/1.2GB	8X	1099

Monitors priced separately



AMD Processor
\$999
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Inteva Multimedia PC

Cyrix Processors

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- SVCD-ROM & Active Imaging speakers
- Over 30 FREE software titles!

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Cyrix	150MHz	16MB/2.0GB	8X	\$1499
Cyrix	166MHz	16MB/2.5GB	8X	1699
Cyrix	200MHz	32MB/2.5GB	8X	1999

Monitors priced separately



Cyrix Processor
\$1499
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*Offer ends 4/15/97

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#0839-00	33.6-56K upgradeable	135.00*
#001171-0	33.6-56K upgradeable	138.00*
#001172-0	33.6-56K upgradeable	169.00*

*Price after manufacturer's rebate. Offer ends 3/29/97

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BJC-4100# Q30-1750-USI-FR...168.97

BJC-70# Q30-1200-325-FR...213.97

BJC-610# Q30-1612-US1-FR...229.97

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Win95 & WinNT, Upgrade, CD# CWOP70-UG-ENG0 199.99

Version 3 for Windows, CD# CWOP 30-ENG0 299.99

Version 3 for Windows, Upgrade, CD# CWOP30-UG-ENG0 199.99

Toshiba Satellite 115CS

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- Pentium 100MHz
- 11.3" Dual Scan
- 8MB RAM
- 772MB Hard Drive
- Includes 3-Year Warranty

PA1224U-S6AB-3Y

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P135 16MB, 2GB, 4x CD	# 133	1299.00

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MWA-100BK

WebTV Internet Unit# MAT960A1\$329.00

WebTV Keyboard# MWK100BK\$9.00

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021-00703

\$40 REBATE OFFER

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Office 97 Upgrade	# 021-00707 \$179.99
Office 97 Upgrade	# 021-00708 \$179.99
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New Media WinSurfer 28.8 Fax/Modem

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NMC01010 While supplies last

Brother 6ppm, 300dpi Laser printer

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brother

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```
Public Sub SetAllowBypassKey(bBypass As Boolean)
'*****
' Sub SetAllowBypassKey(bBypass As Boolean) Access 97
'
' Sets the AllowBypassKey property of the Properties
' collection of
' the current database to either True or False. Takes
' effect the next
' time the database is opened.
'*****
Dim dbs As Database, prp As Property
Const conPropNotFoundError = 3270
'Occurs if the property doesn't exist
Const strKey = "AllowBypassKey"
'Our property name
Set dbs = CurrentDb
'Set object to the current database
On Error GoTo SetAllowBypassKeyErr
'Specify error handler
If bBypass = False Then
    dbs.Properties(strKey) = False
'Set AllowBypassKey to False
Else
    dbs.Properties(strKey) = True
```

```
'Set AllowBypassKey to True (default)
End If

SetAllowBypassKeyExit:
Exit Sub

SetAllowBypassKeyErr:
If Err = conPropNotFoundError Then
' Property doesn't exist yet
If bBypass = False Then
' Create the property
Set prp = dbs.CreateProperty(strKey, dbBoolean,
False)
Else
Set prp = dbs.CreateProperty(strKey, dbBoolean,
True)
End If
dbs.Properties.Append prp
' Add it to the collection
Resume SetAllowBypassKeyExit
End If

End Sub
```



FIGURE 1: You can use the *SetAllowBypassKey* procedure to change the *AllowBypassKey* property to *True* or *False*. The setting takes effect the next time you open the database.

there is a way for us programmers to prevent users from doing this?

ROBERT B. JONES
via the Internet

PC MAGAZINE: You have several alternatives, depending on which version of Access you're using. If you're using Access for Windows 95 or Access 2.x, you can use the /X command line argument to call your own macro at start-up. This way, you can place any important start-up code in your own macro or in a routine called by your macro instead of in AutoExec, which can easily be bypassed. For example, the following command line starts up Access, executes the AutoExec macro (if it exists), and then executes the Startup macro:

C:\MSOffice\MSACCESS.EXE /X Startup

Another possibility if you're using Version 2.0 is to purchase the Microsoft Access Developer's Toolkit, which includes a runtime version of Access. Applications created with the runtime automatically ignore the Shift-key bypass.

If you're using Access for Windows 97, the AllowBypassKey property setting will be of interest to you. This property, which you can add to the Properties collection of your database, controls whether or not the Shift-key bypass is allowed. When set to True, the Shift-key bypass is allowed. When set to False, the Shift key is ignored.

You can modify this property setting with a Visual Basic for Applications routine like

the one shown in Figure 1. The SetAllowBypassKey subprocedure can be passed either True or False, and it will set the AllowBypassKey property in the current database accordingly. The code looks for the AllowBypassKey property in the Properties collection of the current database. If the property is there, SetAllowBypassKey sets it. If no AllowBypassKey property exists, the code creates one and then sets it.

To give this code a try, open your database, select Modules, and either open an existing module or choose New to create a new one. Then select the Insert menu and choose Procedure. When the Insert Procedure dialog appears, type SetAllowBypassKey for the Name, select Sub, and click OK. Access will insert the following:

```
Public Sub SetAllowBypassKey()

End Sub
```

Modify the first line so that it matches the first line in Figure 1, then type in the rest of the code in Figure 1. Make sure there's only one End Sub line at the end.

Now select the Debug menu and choose Compile and Save All Modules. If Access asks, give your module a name. Then select the View menu and choose Debug. When the Debug window appears, type in

```
Call SetAllowBypassKey(False)
```

And then press Enter. Because you entered

False, your Shift-key bypass will now be disabled for this database. If you want to verify this, close the database and then open it again while holding down the Shift key. Now you shouldn't be able to skip the AutoExec macro.

You can download the SetAllowBypassKey code from PC Magazine Online. Look for the file SETBY.VBA in the April 22, 1997, volume archive. (For more details, see the sidebar "Getting the Files" in this issue's Utilities column.)—*Sal Ricciardi*

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A photograph of a Toshiba hard drive. A CD-ROM is placed on top of the drive, with its center hole aligned with the Toshiba logo on the drive's faceplate. The drive is silver and black, and the CD is a standard yellowish-gold color.

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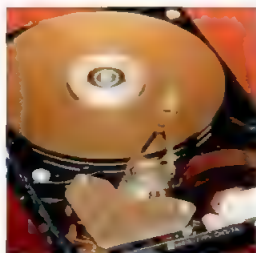
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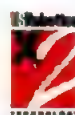
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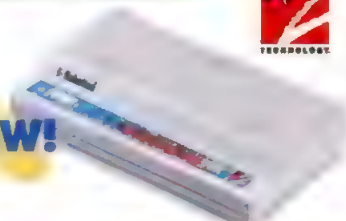
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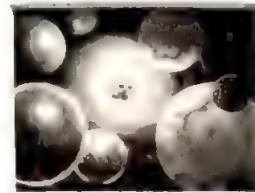
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EO17

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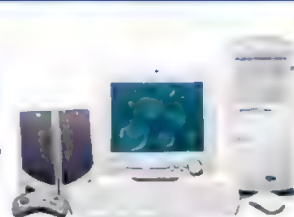
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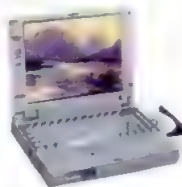
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Immune II 2.0 Windows® 95/3.1 3.5"	#13583	24 ⁹⁷
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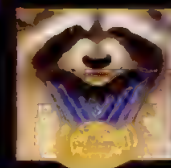
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PC Name	Model	Processor/Speed	Hard Drive	Cash	CD-ROM	Medium	Price
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36072	PCV 90	200MHz	2.5GB	256K	8X	28.8/14.4	1799
36066	PCV 100	166MHz	2.5GB	256K	16X	33.6/14.4	1999
36067	PCV 120	200MHz	3.8GB	256K	16X	33.6/14.4	2399

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Affordable 100MHz Pentium Performance
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Acer

PCC Model	Model	Processor/Speed (MHz)	Display	Hard Drive	RAM Std/Max	Modem	Price
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35485	Light 272	Pentium 120	11.3" DSTN Color	1.0GB	16MB/64MB	6x	1900
36050	Light 333	Pentium 133	11.3" DSTN Color	1.0GB	16MB/64MB	10x	2199
36059	Light 374	Pentium 133	11.3" Active Color	1.0GB	16MB/64MB	10x	2799

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35442	E P133 DN	Pent 133	Dual 11.3"	1.0GB	16/40MB	1500	
36744	E P133 D	Pent 133	Dual 11.3"	1.0GB	16/40MB	28.8	1699
36746	E P133 QC	Pent 133	Dual 11.3"	1.0GB	16/40MB	-	1699
36748	E P133 T	Pent 133	TFT 11.3"	1.0GB	16/40MB	28.8	1999
36749	E P133 TC	Pent 133	TFT 11.3"	1.0GB	16/40MB	-	1999

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35401

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The Pison Series 3c is a fully functional computer, complete with a preemptive multi-tasking operating system that's fast, expandable, and windows driven.



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COMPAQ



PCC Model	Model	Processor/Speed (MHz)	Display	Hard Drive	RAM Std/Max	Modem	Price
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30515	ARMADA 1120T	Pentium 100	10.4" Active	810MB	8MB/24MB	NiMH	1798
36391	ARMADA 1130	Pentium 120	10.4" Passive	1.0GB	16MB/48MB	NiMH	1598
36393	ARMADA 1130T	Pentium 120	10.4" Active	1.0GB	16MB/48MB	NiMH	1948

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- 133MHz Intel Pentium® processor
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- 256 KB L2 Cache
- 1.6GB Hard Drive
- 2MB DRAM
- 8X EIDE CD-ROM
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- Microsoft Software Bundle*
- Windows 95
- Keyboard, Mouse
- 1 Year Warranty, 30 Day Guarantee
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17" 0.28 SVGA Monitor.....499
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- 512KB L2 Cache
- 2.1GB Hard Drive
- 2MB DRAM
- 8X EIDE CD-ROM
- 16-bit Sound Card & Speakers
- Microsoft Software Bundle*
- Windows 95
- Keyboard, Mouse
- 1 Year Warranty, 30 Day Guarantee
- Mini-Tower Chassis¹

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17" 0.28 SVGA Monitor.....499
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- 200MHz Intel Pentium® processor
- 32MB EDO RAM
- 512KB L2 Cache
- 2.5GB Hard Drive
- 2MB DRAM
- 8X EIDE CD-ROM
- 16-bit Sound Card & Speakers
- Microsoft Software Bundle*
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2X6 Sony (CDU926S)	\$369
4X4 Teac, tray loading (CDR50S)	\$589
4X6 Yamaha (YCDR400)	\$659

2 - CHOOSE INTERNAL OR EXTERNAL

If internal - go on to step 3. If external, add an external case (EXTCDCASE) \$100, and the proper cable. We will even install the drive in the case for you.

3 - CHOOSE YOUR SOFTWARE

Incat Easy-CD	\$50
-Supports Windows 3.1, 95, NT (INCATPC)	
Astarte Toast CD-ROM Pro	\$85
-Supports Macintosh (TOAST)	
Elektrosen Gear Multimedia for PC	\$69
-Supports OS/2, Windows 3.1, 95, NT	
-Also supports Macintosh (GEAR)	
Creative Digital Research CDR HYCD for PC	\$379
-Supports Windows 3.1, 95, NT	
-Creates hybrid CDs for PC/Mac/Unix (CDRHYWIN)	

4 - CHOOSE YOUR SCSI CONTROLLER

16Bit ISA PIO Adaptec (A1505CDKIT)	\$50
16Bit ISA Bus Master Advansys (ABP5140)	\$95
32Bit PCI Bus Master Advansys (ABP940)	\$125
32Bit PCI PIO Adaptec (A2920KIT)	\$159
32Bit PCI Bus Master Adaptec (A2930KIT)	\$189

CDR-74 Recordable CD Media

	Alone	w/CDR Drive
5 Pack (CDR74-5)	\$32	\$29
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50 Pack (CDR74-50)	\$249	\$242
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	System	Extra Cartridge	Extra Frame
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SCSI	\$85	\$40	\$54
WIDE SCSI	\$129	\$64	\$75

Weather resistant case to store and transport cartridge \$55

OPTICALS

All Optical Drive prices below include 1 FREE cartridge.

230MB Fujitsu IDE	\$309
230MB Smart Storage Solutions SCSI	\$339
640MB Smart Storage Solutions SCSI	\$469
640MB Fujitsu (230MB backwards compatible)	\$479
2.6Gig Smart Storage Solutions	\$1649
2.6Gig Maxoptix	\$1669
2.6Gig Hewlett Packard	\$2069
52Gig Sony 20 slot Juke box w/ 2.6 Gig drive	\$4599

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540MB MCD Call about manufacturer's rebate	
Compatible w/ SyQuest 270MB media. SCSI Int/Ext	\$249/\$299
230MB SyQuest	
External SCSI or parallel with 1 free disk	\$285
100MB Zip	
External SCSI with 1 disk/Ext Parallel with 1 disk	\$189/\$189
1 GB Jaz	
Internal SCSI with 1 disk/Ext SCSI with 1 disk	\$379/\$469
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PD Drive - 650MB optical & 4X CD ROM in one unit!	
Kit with 1 free disks & controller	Int. \$299 Ext. \$399

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These COMPLETE KITS include drive, controller, software, and 1 recordable CD disk. Smart Storage Solutions kit includes 5 FREE recordable CD disks!

Smart Storage Solutions	2X Write 6X Read	\$429
Hewlett Packard	2X Write 6X Read	\$509
Smart Storage Solutions	4X Write 4X Read	\$769

CD ROM DRIVES

SCSI

Brand	Spin	Model	Speed	Int	Ext
Plextor	12X	PX12TS	105ms	\$265	\$355
PLexor	12X	PX12CS	105ms	\$309	\$399
Toshiba	12X	XM5701B	115ms	\$169	\$259
Toshiba	15X	XM3801B	99ms	\$259	\$349
NEC	16X	CDR1610	100ms	\$199	\$289

ATAPI IDE

Brand	Spin	Model	Speed	Int	Int kit
Mitsumi	8X	CRMCFX800	150ms	\$109	\$139
Cyber	12X	CYBER12X	150ms	\$115	\$145
Lite On	12X	LTN126A	155ms	\$115	\$145
Acer	12X	AC612A	125ms	\$119	\$149
Toshiba	12X	XM5702B	115ms	\$145	\$175
Teac	12X	CD512E	160ms	\$145	\$175
Mitsumi	12X	CRMCFX12X	150ms	\$125	\$155
Lite On	16X	LTN262A	120ms	\$145	\$175
Mitsumi	16X	CRMCFX16X	120ms	\$155	\$185
Acer	16X	AC706A	120ms	\$155	\$185
NEC	16X	CDR1600	100ms	\$165	\$195
Acer	18X	AC616A	120ms	\$160	\$190

Parallel Port case for IDE \$99 PCMCIA case for IDE \$189

Sound Blaster 16 PnP \$99 AWE64Pnp \$180

IDE CD ROM CHANGERS

NEC	4X	CDR4X4	4 Disk	250ms	\$99
NEC	6X	CDR4X6	4 Disk	165ms	\$109
NEC	8X	CDR4X8	4 Disk	165ms	\$175
Panasonic	10X	SQTC510N	5 Disk	130ms	\$249

SCSI CD ROM CHANGERS

Nakamichi	8X	MJ48S	4 Disk	150ms	\$279
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TAPE DRIVES

QIC MINICARTRIDGE

Includes DOS/Win backup software and 1 free tape.

800MB Seagate	TST800R	\$119
3.2Gig Seagate	TST3200RFT	\$185

PRINTER PORT MINICARTRIDGE

Includes DOS/Win backup software.

800MB Seagate	TST800RPT	\$149
3.2Gig Seagate	TST3200RP	\$215

IDE or SCSI TRAVEL

Includes DOS/Win backup software and 1 free tape.

4-8GB Seagate	TST8000(A)	\$339
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SCSI 4mm DAT

2GB Hewlett Packard	C1534AI	\$609
2-4GB Seagate	C4324RP	\$660
2-4GB Hewlett Packard	C1536AI	\$679
4-8GB Sony	SDT5000AI	\$809
4-8GB Seagate	C4326NP (DDS2)	\$799
4-8GB Sony 90MB/min	SDT7000AI	\$909
12-24GB Sony	DDS3 SDT9000AI	\$1179
12-24GB HP	DDS3 C1554AI	\$1479
24-48GB HP	External 6 tape loader C1553AX	\$2439
32-64GB Sony	TSL7000 8 tape autoloader	\$2199
48-96GB Seagate	C4586NP 12 tape autoloader	\$2399

SCSI 8mm DAT

3.5-7GB Exabyte	EXB8205XL	\$1269
7-14GB Exabyte	ELIANT820	\$1725
7-14GB Exabyte	EXB8700LT	\$959
20-40GB Exabyte	EXB8900	\$4549
70-140GB Exabyte	EXB10H 10 tape autoloader EXT	\$3799

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NovaStor's NovaDisk CD contains software to backup to disk drives and removables	\$79
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IDE HARD DRIVES

IDE	Speed	RPM	Brand	Model	Wty	Price
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1200MB	14ms	4103	JTS	JTS1200	3	\$179
1275MB	12ms	4500	Seagate	ST31276A	3	\$195
1200MB	11ms	4500	Quantum	TM31280A	3	\$192
1281MB	11ms	5200	Western Digital	WDAC11200	3	\$199
1624MB	10ms	5200	Western Digital	WDAC21600	3	\$209
1670MB	11ms	4480	Maxtor	M81750A	3	\$210
1700MB	10ms	5400	Fujitsu	M1623T	3	\$194
1700MB	12ms	4500	Seagate	ST31720A	3	\$205
2000MB	14ms	4103	JTS	JTS2000	3	\$219
2100MB	9ms	5400	Fujitsu	M1624T	3	\$224
2111MB	12ms	5200	Western Digital	WDAC22100	3	\$229
2132MB	12.5ms	4500	Seagate	ST32132A	3	\$229
2151MB	10ms	5400	Quantum	FB32160A	3	\$259
2168MB	10.5ms	4500	Quantum	TM32160A	3	\$235
2187MB	12ms	4480	Maxtor	M82187A	3	\$239
2500MB	8ms	5400	Fujitsu	M1638T	3	\$229
2550MB	15ms	3600	Quantum	BF2550A	3	\$225
2550MB	10.5ms	4500	Quantum	TM32550A	3	\$249
2559MB	11ms	5200	Western Digital	WDAC32500	3	\$255
2560MB	11ms	5400	Seagate	ST32520A	3	\$249
2560MB	10ms	5400	Maxtor	M82560A	3	\$259
3166MB	12ms	5200	Western Digital	WDAC33100	3	\$295
3228MB	10ms	5400	Quantum	FB33240A	3	\$309
3245MB	12ms	4500	Seagate	ST33240A	3	\$315
3254MB	10.5ms	4500	Quantum	TM33200A	3	\$285
3500MB	12ms	4480	Maxtor	M83500A	3	\$329
3840MB	10.5ms	4500	Quantum	TM3380A	3	\$315
4000MB	12ms	5200	Western Digital	WDAC34000	3	\$375
4310MB	10ms	5400	Quantum	FB34320A	3	\$375
4326MB	12ms	4500	Seagate	ST34340A	3	\$Call
4335MB	14ms	3600	Quantum	BF4335A	3	\$294
5120MB	10ms	5400	Maxtor	M85120A	3	\$449
6448MB	10ms	5400	Quantum	FB36480A	3	\$539
6510MB	14ms	3600	Quantum	BF6510A	3	\$439

SCSI HARD DRIVES

SCSI	Speed	RPM	Brand	Model	Wty	Int	Ext
1050MB	9ms	5400	Seagate	ST31055N	3	\$299	\$369
1280MB	12ms	4500	Quantum	TM31280S	3	\$269	\$339
2110MB	10.5ms	4500	Quantum	TM32110S	3	\$309	\$379
2150MB	9ms	5400	Seagate	ST32155N	5	\$475	\$549
2150MB	8ms	7200	Seagate	ST32171N	5	\$649	\$719
2151MB	10ms	5400	Quantum	FB32160S	3	\$339	\$409
3228MB	10ms	5400	Quantum	FB33240S	3	\$389	\$459
3254MB	10.5ms	4500	Quantum	TM33200S	3	\$355	\$425
4100MB	7.9ms	7200	Micropolis	MC4341	5	\$739	\$809
4310MB	10ms	5400	Quantum	FB34320S	3	\$479	\$549
4350MB	8ms	7200	Seagate	ST34371N	5	\$989	\$1059
4350MB	8ms	7200	Fujitsu	M2954S	5	\$799	\$869
4550MB	8ms	7200	Quantum	XP34550S	5	\$879	\$949
4550MB	7.9ms	7200	Micropolis	MC4345	5	\$825	\$895
4550MB	7.9ms	7200	Micropolis	MC4345AV	5	\$909	\$979
6448MB	10ms	5400	Quantum	FB36480S	3	\$599	\$669
6448MB	8.5ms	7200	Micropolis	MC3391	5	\$1345	\$1415
9091MB	8.5ms	7200	Micropolis	MC3391AV	5	\$1459	\$1529
9100MB	9ms	7200	Seagate	ST19171N	5	\$1869	\$1939
9100MB	8ms	7200	Quantum	XP39100S	5	\$1399	\$1469
9100MB	10ms	7200	Fujitsu	M2949S	5	\$1439	\$1509
23.3GB	13ms	5400	Seagate	ST423451N	5	\$3869	\$3969

WIDE SCSI

1050MB	9ms	5400	Seagate	ST31055W	5	\$369	\$499
2150MB	9ms	5400	Seagate	ST32155W	5	\$499	\$629
2150MB	8ms	7200	Seagate	ST32171W	5	\$679	\$749
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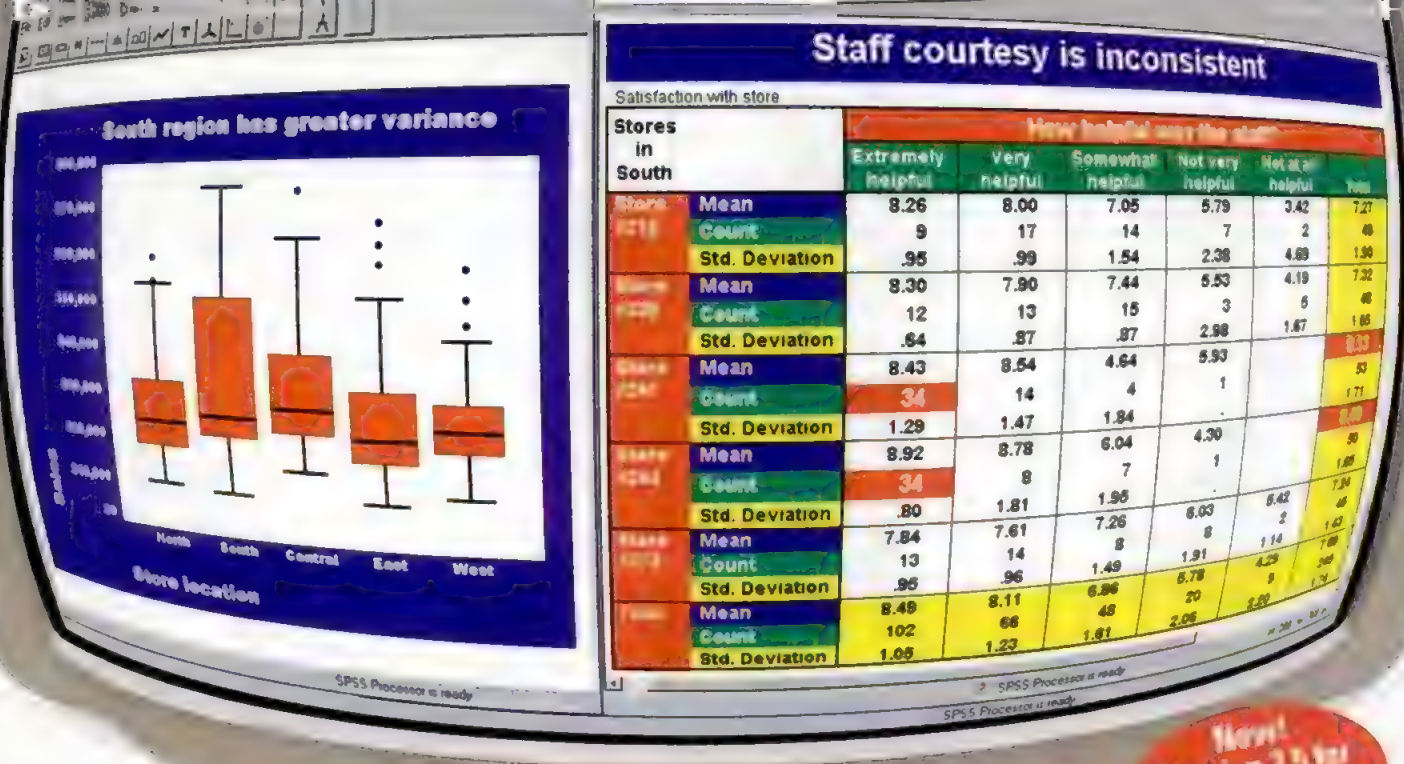


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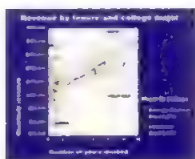
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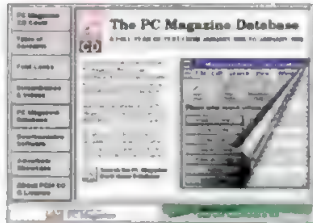
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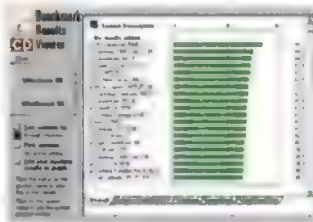
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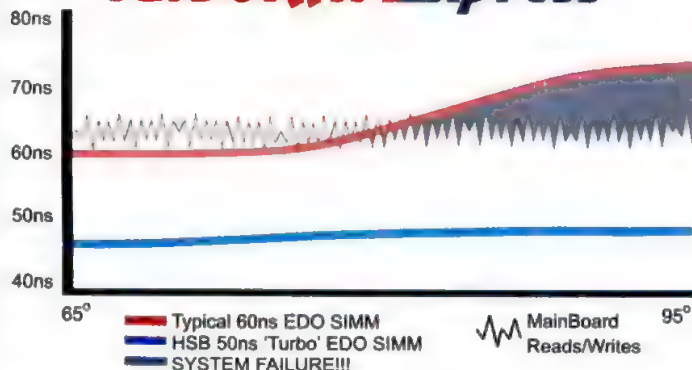
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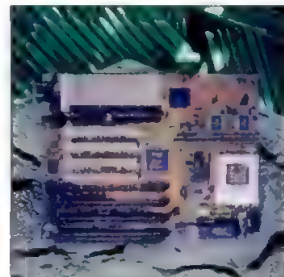
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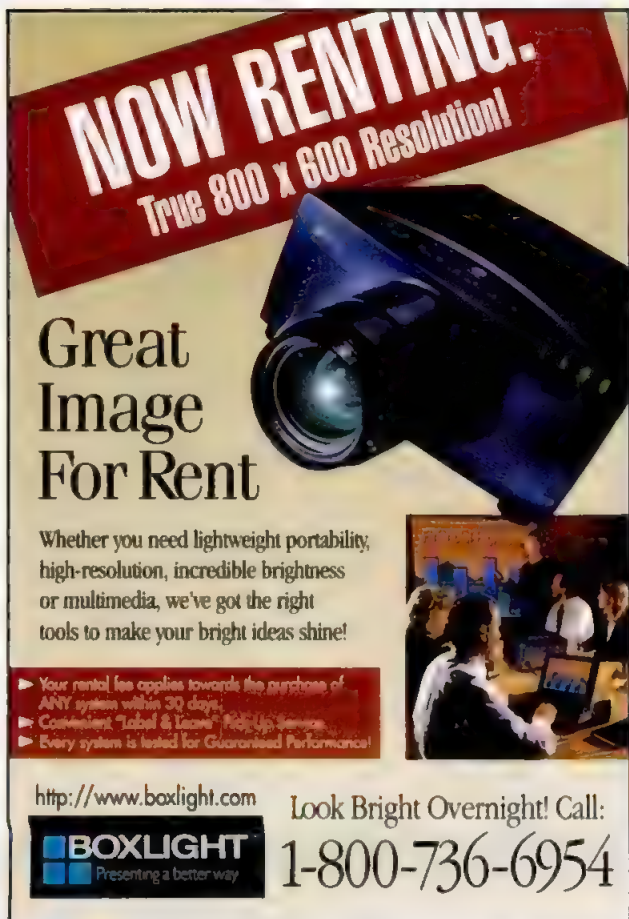
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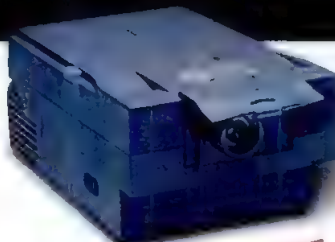
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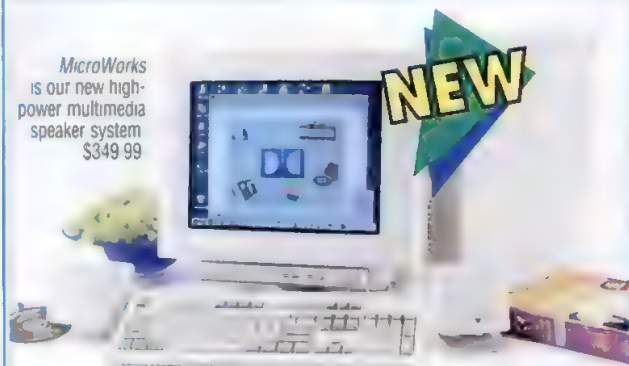
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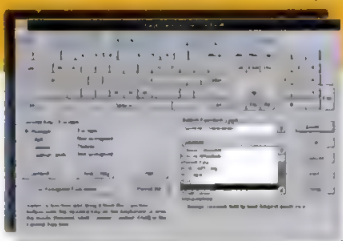
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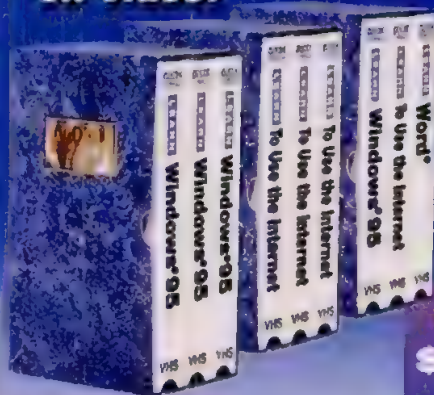


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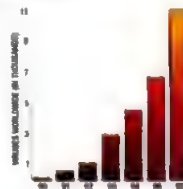
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SOURCE — Virus Bulletin, October 1996
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SOURCE — Secure Computing, January 1997
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• For Microsoft Windows 95: 16 MB RAM recommended with 32 MB • Microsoft Windows 95 or higher
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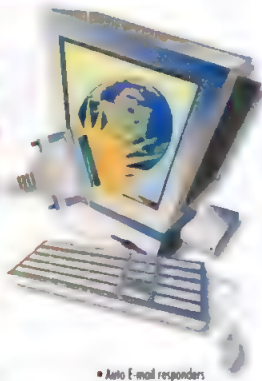
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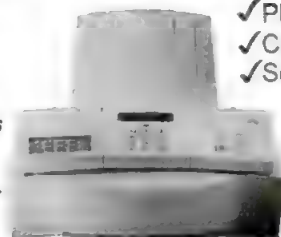
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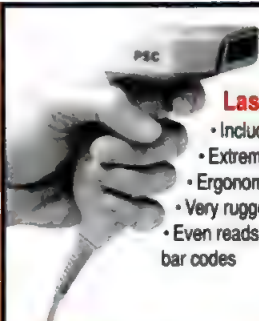
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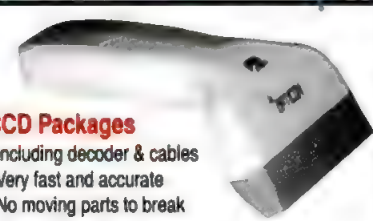
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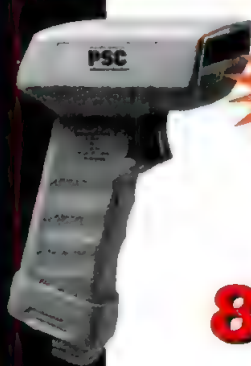
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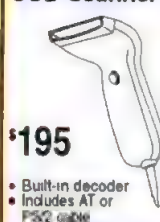
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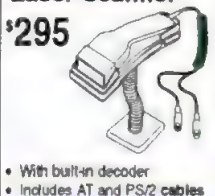
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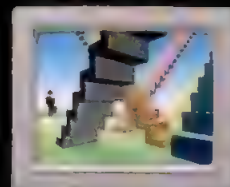
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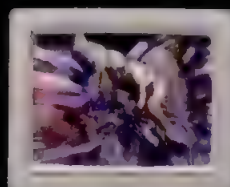
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The Surreal Thing

SegaSoft's new adventure game is a fantastic journey into a bizarre and baffling world.

Obsidian

Let's make one point absolutely clear: Obsidian is unlike any other computer game currently on the market. Granted, the images on this page may bring Myst and other similar games to mind. But the manner in which Obsidian integrates high-resolution animation and full-motion video will probably push all thoughts of comparisons from your mind. The game is that impressive.

But we also need to make another point: Obsidian needs some serious hardware to run. In fact, this Windows 95 game calls for a Pentium/90 with 16MB RAM, 16-bit graphics, and a quad-speed CD-ROM drive. These are the minimum system requirements, however—the game ran poorly with choppy animation on such a machine. We recommend a Pentium/120 or better.

If you have the hardware, you'll find Obsidian a veritable feast of sights and sounds not



normally found in adventure games. The animation is arguably the best we've seen. Adventure games typically use full-motion video only for transitions or introductions, but Obsidian's video sequences are seamlessly incorporated into the flow of the game—and they greatly enhance game play.

The game takes place in the year 2066. You are cast as Lilah Kerlin, a scientist and engineer;

with your associate Max Powers, you designed and launched the Ceres satellite. Ceres is built to use nanotechnology to help restore the Earth's not-so-healthy atmosphere. Now, 100 days after the launch, you and Max decide to celebrate by tak-

ing a camping vacation in one of Earth's last remaining forests. While exploring, you discover a mysterious chunk of black, shiny rock, which is growing at a rate of several feet per day. Now the rock (which you affectionately name *Obsidian*) has grown into an enormous tower. You find out the brief history of Obsidian by spending more time than you probably should reading through the notes on your personal digital assistant. You then discover that Max has been sucked into the tower, and, as you investigate, you too are drawn into Obsidian.

Now the fun really begins. You're transported to a room straight out of your own nightmares. You see your dreams manifested as a chaotic Bureau room straight from an Escher painting. Max's dreams, too, find a place here in the form of an intimidating mechanical spider. All of these suddenly concrete environments have come to life, thanks to an out-of-control Ceres.

As in any adventure game, you must solve a number of puzzles to progress through it and figure out what's going on. This is the one spot where Obsidian stumbles slightly. The puzzles in this game are very difficult to solve. While this makes for many hours of game play, it can also lead to many hours of frustration. After all, the instruction manual includes a near-complete walkthrough of a large chunk of the game—always a bad sign.



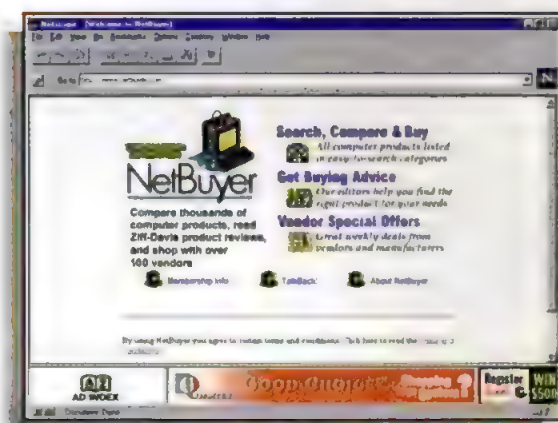
Nevertheless, this is one very impressive title. Beautiful, bizarre, and baffling, Obsidian is the game of choice for any adventure gaming fan. —Shane Mooney



IN AFTER HOURS

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Do You Feel the Need?

Four high-flying jet combat simulations that should suit a variety of armchair pilots.

A-10 Cuba!

In the current days of texture mapping and advanced 3-D graphics engines, Activision's A-10 Cuba! may not look like much at first glance. But underneath the solid-colored polygons lies a decent, re-



alistic jet combat simulation. Unfortunately, the game has glaring shortcomings.

A-10 Cuba! is a Windows 95 game with very reasonable system requirements: a 486/66 with 8MB RAM (assuming you would actually load Windows 95 on such a machine). Any Pentium system should run the game at near-lightning speed.

In terms of on-screen realism, this is a remarkable game. The flight model is very impressive, as are the in-flight graphics, even though they look a little plain at first. The truth is that the simple graphics engine allows for outstanding performance and high frame rates, even at 1,024-by-768 resolution on a Pentium/120.

But the game is far from perfect. To begin with, A-10

Cuba! offers no way to communicate with wingmen, no variable-difficulty modes, no way to turn off stalls, and no option to skip takeoffs and start in the air. In addition, the game lacks a mission editor—which wouldn't be a big drawback except that there are only 12 missions to fly.

The biggest problem, however, is the lack of a printed manual. The only help available is online—an awkward, unintuitive method for presenting so much information.

A-10 Cuba! is ideal for flight simulation fans with older systems and a taste for realism. Otherwise, we recommend taking a look at the other products reviewed here.—SM

F-22 Lightning II

If you're looking for a jet combat simulation with spectacular graphics and a heavy emphasis on action, F-22 Lightning II is your game.

F-22 Lightning II is a DOS game that runs very well under Windows 95—often better, in fact. The game requires at least a 486/DX4 with 8MB



RAM, but you'll want something much faster to appreciate it fully. A Pentium/166 with 16MB RAM is our recommendation.

The box for F-22 Lightning II claims that the game is "the most realistic, action-packed jet fighter simulation ever created." We can't argue the action part—most of the 36 missions pit you and a solitary wingman against wave after wave of bad guys—but the realism is questionable.

In all fairness, F-22 Lightning II is fun to play, because the flight model and controls are simple and easy to learn. Novices will certainly appreciate this user-friendly approach, and the game will appeal much more to this group than to hard-core flight simulation enthusiasts.

The game has some of the best and most detailed graphics we've seen in flight simulation, particularly in terms of the terrain. The multiplayer support is also impressive: up to eight players over IPX networks, two over modem and direct serial links.

But we found the arcade-style air combat a tad over-simplified and the computer-controlled enemies rather dim.

For fun, easy jet combat action, F-22 Lightning II is one of the best games around. Just don't expect a lot of realism.—Michael E. Ryan

JetFighter III

Although based on the same aircraft as NovaLogic's F-22 Lightning II, JetFighter III places a higher emphasis on realism than on arcade-style action. The result is a jet combat simulation on a par



with such classics as EF2000 and Falcon 3.0.

JetFighter III is a DOS game that will run well under Windows 95, but only with an update from the developers' Web site (www.missionstudios.com). You can also download additional missions for the game from this site.

Minimum system requirements call for a 486/100 with 8MB RAM. In a low, 320-by-200 resolution, the game runs fine, but for higher-resolution flying, you'll need a Pentium/133 with 16MB RAM.

The game lets you fly more than 90 well-designed, carrier-based missions over Chile, Cuba, and Florida using either an F-22 Lightning II or an F/A-18 Hornet.

JetFighter III's realistic flight model and graphics rival those of NovaLogic's F-22 Lightning II. The game also utilizes an intuitive interface for moving about the carrier between missions.

The missions are tough and realistic. Nice touches include other aircraft flying cover for your bombing runs (versus the "do everything yourself" approach), jarring effects for antiaircraft fire, and well-rendered terrain.

The only drawback here is a lack of multiplayer support—something offered by all of the other products in this roundup.

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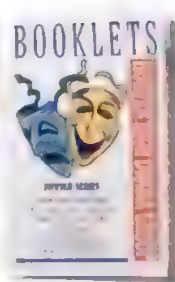
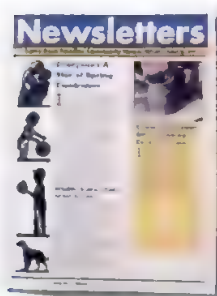
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If you consider yourself a fair hand at flying and you itch for a realistic air combat challenge, JetFighter III is definitely the game for you.

—MER

USNF '97

Electronic Arts' popular U.S. Navy Fighters is back and better than ever. The latest version, USNF '97, is quite a package for flight simulation fans—even for those who have played previous versions of the game.

USNF '97 is a Windows 95-only game that requires a Pentium/90 with 16MB RAM and a 4X CD-ROM drive. But like previous versions, the game just barely runs under these conditions. We recommend a Pentium/120 or better.

The game includes the original U.S. Navy Fighters, the Marine Fighters expansion pack, a new Vietnam

campaign, four new planes to fly, and new multiplayer support. You can fly 110 designed missions, plus any number of custom-designed sorties.

U.S. Navy Fighters has long been known for its impressive graphics. USNF '97 remains a Super VGA showstopper, despite the fact that the terrain looks a bit dated.

But it really shines with the addition of multiplayer support: You can now have up to eight players flying over an IPX network (two over a modem or direct se-

rial link). A recently released patch adds TCP/IP support for Internet play.

Anyone looking for lots of jet combat action should enjoy this one. And while owners of the original might pass on this reissue, the new campaign and multiplayer support should justify the price of admission.—SM



QUICK CLIPS



Freddi Fish and Luther's Maze Madness

A Pac-Man-style arcade game for 3- to 8-year-olds starring our favorite fish and her best friend. Nothing flashy here—just a lot of fun highlighted by good animation, lively music, and more than 100 challenging levels. \$14.95 list; Humongous Entertainment, 800-499-8386, www.humongous.com.



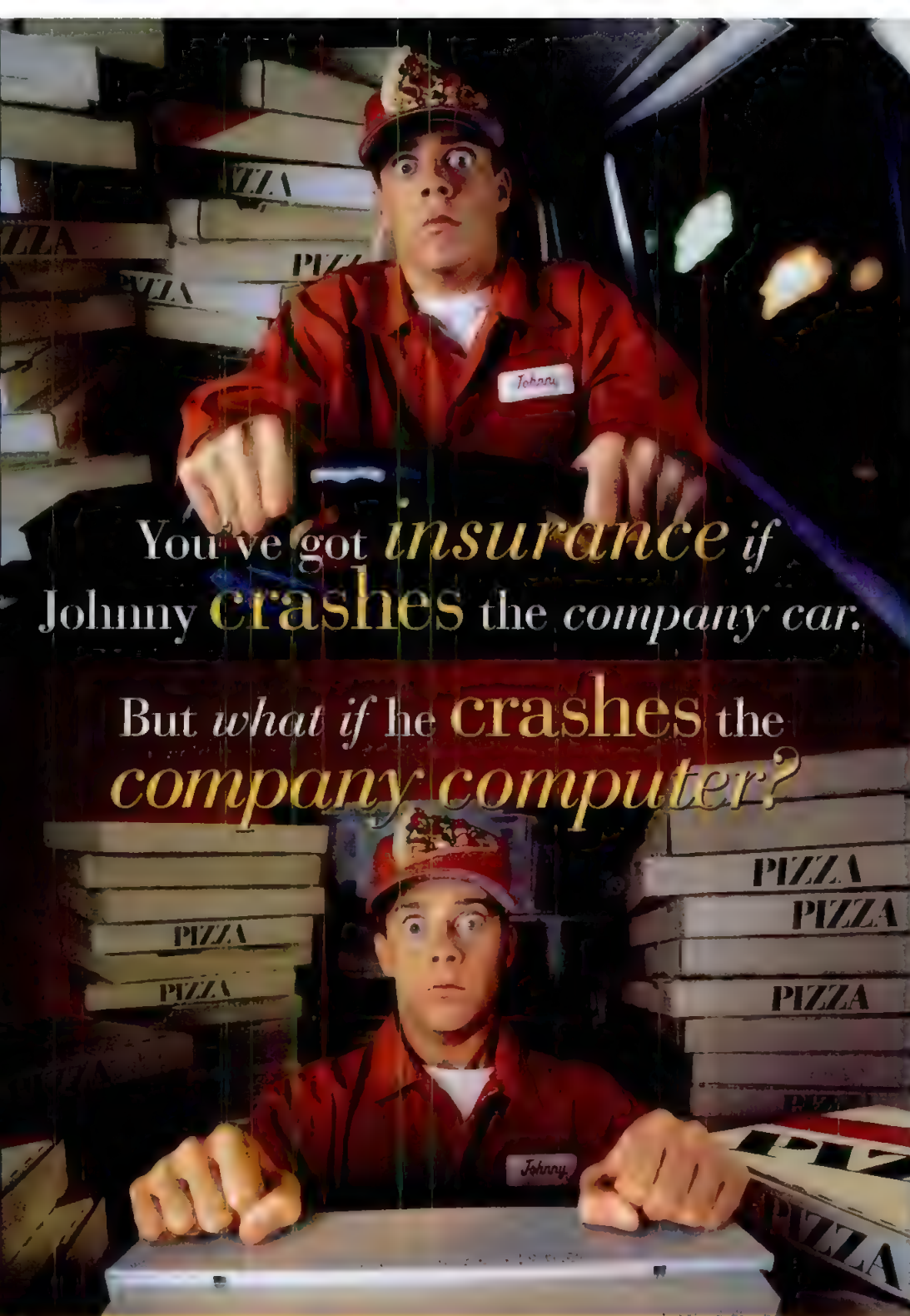
Banzai Bug

A very different kind of flight simulator, in which you play the title role. You are trapped in an exterminator's house and have to survive long enough to drive him and his family out. Very cool 3-D graphics add a solid visual punch to a very enjoyable game. \$39.99 list; Grolier Interactive, 203-797-3530, www.grolier.com.



Avery Cardoza's Casino

This graphical gambling game software has some high points—well-rendered, witty dealers—and a great many games to choose from. Unfortunately, it loads and runs slowly even on fast systems. \$49.95; Cardoza Entertainment, 619-794-0401.



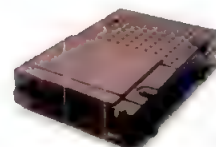
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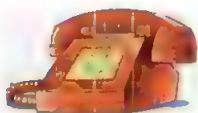


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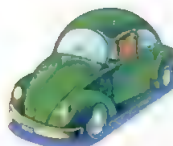


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A Frightful Night

Interplay's attempt to mix action and adventure gets mixed results.

Realms of the Haunting

Billed as "the ultimate horror adventure," *Realms of the Haunting* tries to combine elements from many different gaming genres—first-person action, adventure, and role-playing games—to provide a thoroughly new experience. While at times the game can be compelling and downright spooky, "the passable horror adventure" would be a more suitable billing.

Realms of the Haunting is a four-CD-ROM DOS game that runs fairly well under Windows 95. It requires a 486, but you'll need a Pentium to run the game in its high-resolution modes (which go as high as 800-by-600).

In the role of Adam Randall, you arrive in the town of Cornwall for the funeral of your father. His suspicious death has spawned a series of nightmares that involve a house you've never seen. You manage to find the house and begin your quest to learn its secrets.

Once inside, things go downhill, as the graphics bring to mind a time when *Wolfenstein 3D* was king of the first-person action genre. This is not to say that they are bad, but players accustomed to *Quake* and *Duke Nukem* will find them wanting.

You spend quite a bit of time wandering about among more than 500 rooms, looking for keys, collecting the odd scrap of paper, and killing whatever demons' spawn you come across. Although the rest of the graphics are plain, at least the monsters are

much more detailed.

But there is much more to the story than wandering around the house killing things. You learn that this was the home of a powerful sorcerer whose experiments have unleashed a whole boatload of demons who have taken your father's soul. You'll need to find the source of the demons' power to free your father. Throughout your quest you'll encounter plenty of tough puzzles and a fair share of theological commentary.

Though it falls down slightly in the graphics department,



the sound effects are awesome. There were a couple of times when we jumped out of our chairs on hearing a demon materialize nearby.

Still, we couldn't help feel-

ing that *Realms of the Haunting* was little more than a not-so-flattering imitation of *Ultima Underworld* or a *DOOM* clone with some adventure elements thrown in.—SM

Man Overboard

Discovery Channel's pirate adventure has some potential but even more problems.

Pirates: Captain's Quest

The premise is a good one: an educational game about pirates and life at sea. But after playing *Pirates: Captain's Quest* for a short while, we

Pirates, which runs on Windows 3.x and 95 as well as Macintosh computers, is intended for kids 9 and older. But the content—which prominently features pillaging as a basic goal and a worm-ridden ghoul who chimes in when the player dies—is more suitable for kids over 14.

Kids get to play male or female ship captains and can choose to be merchants, privateers, or pirates. Each role has a different goal.

For example, merchants make money through trade, while pirates pillage their way through the game.

Players get to sail around the Caribbean, visit 34 ports, converse with residents, fight sea battles, and duel against enemy captains.

The game is not without merit. The graphics, particularly those on the stylized ship's deck, are first-rate. Similarly, the sea battles are simple and fun. And the game does provide a lot of information on the subject matter.

In addition to the questionable portrayal of pirates as heroic characters, the game suffers from a number of faults. The resource management element is too complicated for the age group. The many voice-overs are poorly recorded and include such conversational gems as "A fellow could get killed—or robbed even."

With some tweaking, *Pirates: Captain's Quest* could have been a decent game. But we can't say that we see much value in this as an educational title.—MER



were unimpressed by the game and even a little disturbed by the game's design.

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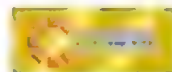
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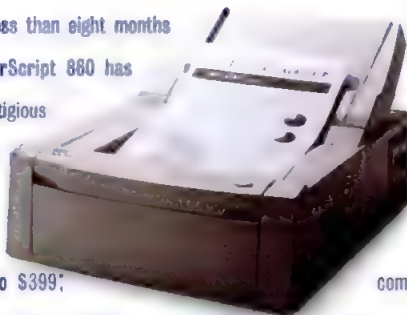
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Coming Up

What's in the Next Issue of *PC Magazine*

The Top 100 Hardware Accessories

Improved keyboards, better mice, ergonomic aids, tools for road warriors, and even toys for kids and gamers. We found 100 inexpensive hardware accessories to make you more productive—or at least let you have a little fun at your PC.

Removable Storage

One peripheral that's becoming essential for most computer users is some kind of removable storage drive. We test 23: Zip, Jaz, SyJet, LS-120, Apex, MO, CD-R, tape, and more.

Online Services

In this year's roundup, we tell you where these venerable services stand against each other—and against the growing popularity of Internet service providers (ISPs).

Low-End Accounting

Small businesses need to practice good accounting at least as much as big businesses do. We review 11 accounting packages for \$200 or less.



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NE—Network Edition.

For information about the Network Edition of *PC Magazine*, call Circulation at 800-289-0429.

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

The  jokesters promoting transportation at the Computer Telephony 97 show leave nothing to the imagination.



Actual bus is larger

Overheard

"If you run an all-you-can-eat restaurant, the last thing in the world you want to see is a bus load of fat people pulling into your parking lot."—DAVID ROCKER, investment analyst for Rocker Partners, discussing online service flat-fee pricing plans. (*The New York Times*, December 17, 1996.)



New ideas in  mass storage. (Ambience Bureau catalog.)

Ouch! Or Should We Say, Pouch?

We humbly apologize to all rodents and marsupials for claiming in a recent issue ("The Best of Abort, Retry, Fail?" January 7, 1997) that possums are the former. They are in fact the latter. Who knew? A possum looks a lot more like a rat than like a kangaroo. Our thanks to the 27 readers who alerted us to the error. We're pretty sure it won't happen again.



 Here's one yuppie who really knows how to travel. (Kingston Technology and Texas Instruments ads.)

What About Data Loss?

"WINDOWS. A new program to help participants deal with losses, such as divorce, death, relocation and retirement, as well as the less obvious losses of everyday life."—OFFUTT AIR FORCE BASE BULLETIN



"I heard you say you needed a new Web dowser, Andy, and I thought that old gramps could help out. But shoot if I can find one that'll work!"

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802 or, via e-mail (text items only), to don_willmott@zd.com. Winners this issue: J. Dailey, David Lilley, Stephen Petrica, and Richard Rubin. Possum logo courtesy of WPZN, 93.5FM, Huntsville, Alabama.

RICHARD TENNANT

CAN YOU REALLY AFFORD TO BUY THE #2 NOTEBOOK?

ANNUAL GUIDE TO COMPUTERS				
Laptops				
TRAVELING COMPANIONS				
RANK	MANUFACTURER	MODEL/SCREEN	CONFIGURATION	COMMENTS
3.1	DELL COMPUTER	Latitude LM P133ST, 12-in. TFT display (133 Mhz)	6.8 lb 16MB RAM, 810MB disk, 6X CD-ROM	Great
2.8	IBM PC CO.	ThinkPad 760ED 1, 2-in. TFT display (133 Mhz)	1.7GB disk, 4X	
2.6	WINBOOK COMPUTER	WinBook 11.7		
2.7	COMPAQ COMPUTER			
2.7	HEWLETT-PACKARD			

— *Business Week*
11/4/96

What's wrong with this picture? The notebook that gives you the most performance, usability and features costs half the price of notebooks that give you less. (Notebooks, by the way, that you probably thought gave you more.) And remember, you have this information on the very best authority. *Business Week*, the business publication, in their Second Annual Computer Buying Guide cited the Dell Latitude LM P133ST as "the top ranked machine in the tests" and the notebook they'd most like to travel with. So if you're shopping for a notebook, buy the best. After all, you can afford it.



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BUDGET DESKTOP BEST BUY - P100t
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5-time BUDGET DESKTOP BEST BUY - XPS P120c
POWER DESKTOP BEST BUY - XPS P90c
BUDGET DESKTOP BEST BUY - XPS P90c
POWER DESKTOP BEST BUY - XPS P166c

★ WINDOWS MAGAZINE

5-time RECOMMENDED LIST - XPS Pro200n
WIN100 '96 HARDWARE AWARDS - XPS line
8-time RECOMMENDED LIST - XPS P166s
11-time RECOMMENDED LIST - P100t
2-time RECOMMENDED LIST - P200v
WIN100 '96 HARDWARE AWARDS - DIMENSION line
2-time RECOMMENDED LIST - XPS Pro200
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